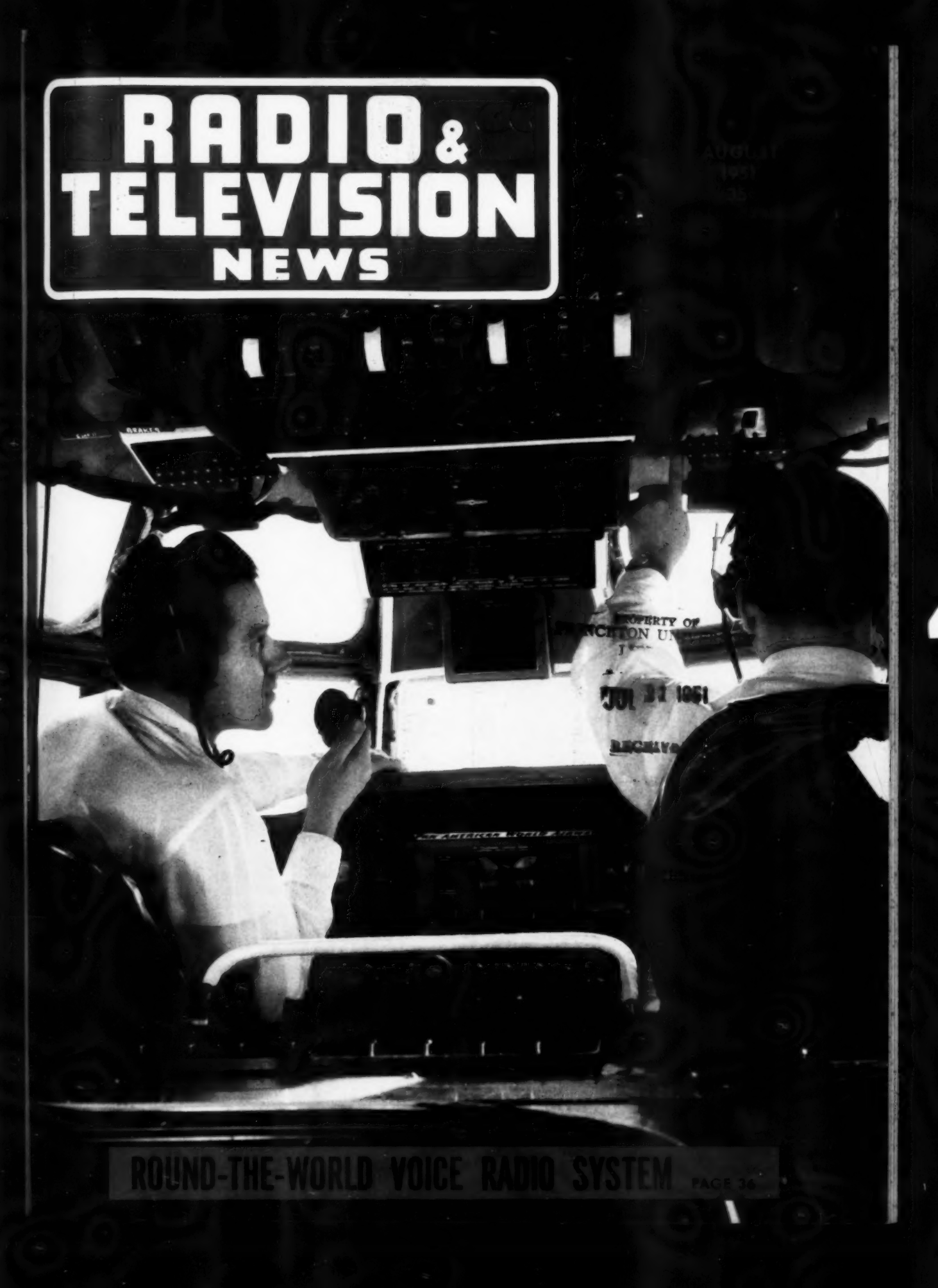
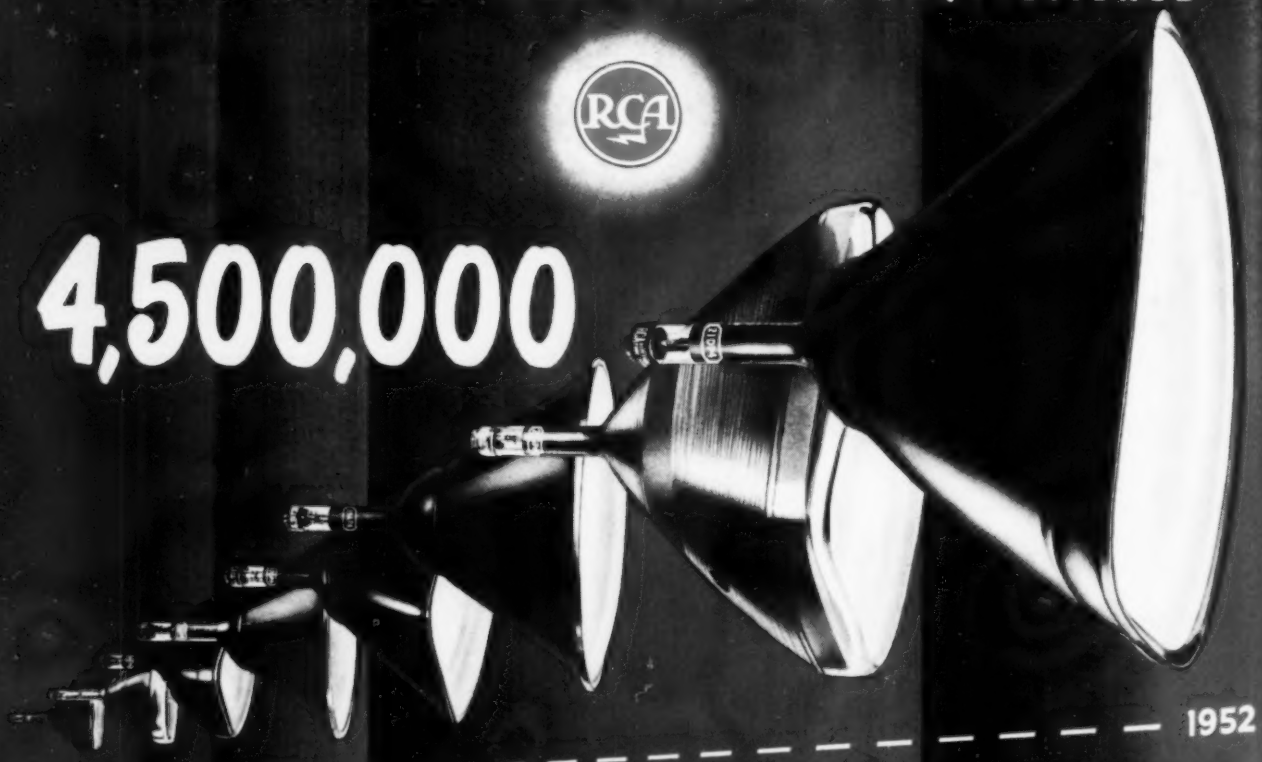
RADIO & TELEVISION NEWS



ROUND-THE-WORLD VOICE RADIO SYSTEM PAGE 36

THE QUALITY OF **RCA** TUBES IS UNQUESTIONED

4,500,000



Best Sellers!

Life expectancy...plus!

RCA kinescopes incorporate the experience of the oldest mass-producer of picture tubes in the industry

It is a well-established fact that more RCA kinescopes are now in active service than any other brand . . . over 4½ million since the advent of commercial television, when RCA pioneered the first large-scale production of kinescopes.

Significantly, many RCA kinescopes installed *four and five years ago are still giving good performance today,* providing continuous reliable service year after year. Yes, RCA picture tubes of all types have consistently given outstanding performance.

RCA's kinescope quality means substantial savings to dealers and servicemen, in fewer call-backs and "out-of-pocket" replacements. In the long run, it amounts simply to this . . . stocking RCA picture tubes is good business . . . as any long-term user of RCA kinescopes will tell you.

Your local RCA Tube Distributor carries a complete line of RCA picture tubes. See him the next time you buy kinescopes for replacement.

Keep informed . . . keep in touch with your RCA Tube Distributor

RADIO CORPORATION of AMERICA
ELECTRON TUBES HARRISON, N.J.

COVER PHOTO: Cockpit of one of Pan-American's world-wide fleet. Radio plays an increasingly important role in keeping planes on schedule under all kinds of flying conditions. (Kodachrome: M. Stanley & P. Friend)

First in
radio-television-electronics
Average Paid Circulation over 200,000

RADIO & TELEVISION NEWS

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DEPARTMENTS

VOLUME 46 • NUMBER 2

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Assures Greater Customer Satisfaction . . .
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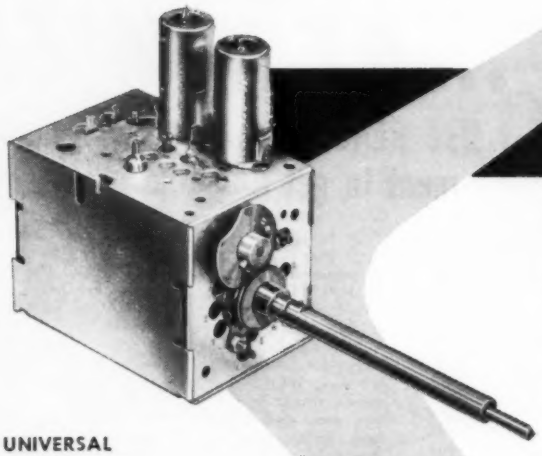

UNIVERSAL REPLACEMENT MODEL

The Tarzian Tuner

Model TT-5R

Embodies latest engineering developments currently being built into TARZIAN TUNER for many leading set manufacturers. Built for easy conversion . . . adaptable to either split-sound or inter-carrier system . . . shaft easily cut to required length . . . available either 21 or 41 megacycles . . . top screw adjustments on traps, IF, plate, grid and antenna circuits . . . rear terminal connections easily accessible with extra tie points provided . . . no messing with coded leads.

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(Rounds or Rectangulars)

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- **Low Tube Noise**

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DISTRIBUTOR SALES OFFICE
Bloomington, Indiana

Service Clinic!

Engineering information to help you better service Raytheon

1. **The Horizontal Oscillator** used in a television receiver provides the left-to-right scanning excitation. This excitation must always be in perfect phase synchronization with the horz. scan of the television station's camera.

2. **The Stabilized Horizontal Multivibrator** oscillator, shown in Fig. 1, uses a stabilizing memory circuit (L23 & C107) to prevent line-by-line displacement of the picture (tearing) as a result of any interfering noise appearing along with the horz. sync.

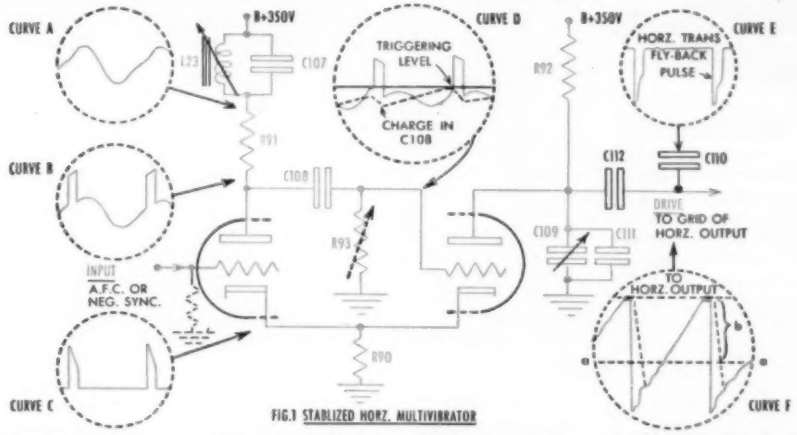

FIG.1 STABLIZED HORZ. MULTIVIBRATOR

3. **The Circuit** shown above is a cathode-coupled stabilized horizontal multivibrator that uses a 6SN7 duo-triode tube. During the period of scan, the first triode is conductive and the second triode is biased beyond Ip cut-off. When the triggering level is reached, as shown in Curve D, the second triode will start to conduct. A positive charge in C109 & C111 has been accumulated through R92 during the period of scan. This will be rapidly discharged by the plate conduction of the second triode.

The rapid discharge current through the cathode-coupling resistor R90 (Curve C) will cause the first triode to cut-off. This will excite oscillation (Curve A) in the stabilized resonator (L23 & C107) as well as producing an additive pulse across R91. (See Curve B.) This pulse will drive the grid of the second triode positive and grid current will flow so as to store a charge in C108. The increasing charge in C108 and the discharge of C109 & C111 will again cause the second triode to cut-off, thus the first triode will resume conduction for the duration of the next scan.

4. **The Free-Running Frequency** is determined by the resonance of L23 & C107 as well as the charge-holding time-constant of C108 & R93. L23 & R93 may serve as the horz. hold controls.

5. **Synchronization** may be A.F.C. or impulse sync. controlled. When impulse sync. is used, the first triode functions as a sync. amplifier and the sync. pulse triggers the second triode ahead of the free-running triggering level. When A.F.C. is used for sync., the first triode functions as a cathode follower that is cathode bias-coupled to the second triode and can change the freq. both faster or slower than the free-running frequency.

6. **The Drive** at the output is controlled by the combined capacitance of C111 and the drive adjustment trimmer C109. The discharge time of the drive (dotted line of Curve F) can be made steeper by the addition of a neg. pulse. (See Curve E.) This reduces horz. output tube loading of the high voltage fly-back pulse by reaching cut-off (dotted Line A) more rapidly within region "b."

7. **Improved Circuitry** such as this is one of many reasons why you can feel free to recommend Raytheon TV to a friend or customer.

For the RECORD

BY THE EDITOR

AS A direct observer of daily developments in the field of electronics, your editor has the privilege (in many cases) of studying the features and circuitry of many fine new products. In too many cases, however, he also runs into "horrible examples" of products, design, descriptive copy, and instruction books. It becomes his prerogative, as a human with normal, though sometimes taxed, temperament to do the proverbial "burn" and to give vent to his feelings!

Let's take, for example, an average auto radio It is priced as high as $110 by some auto dealers, yet these sets do not include a single refinement (electrical or mechanical) made since the introduction of the permeability tuner. It was many years ago that we hailed the loctal tube and its retaining socket. These, we were told, would greatly improve the auto set and prevent tubes from shaking loose from their sockets. Vibrators, too, would be secure and stay where they should be. Another "feature" (?) that brings tears to the eyes of the technician is the auto receiver chassis mounted in an upside down position. That is, the tubes are mounted toward the bottom in an inverted position with vent holes located in the bottom of the case. The manufacturers have obviously forgotten that heat rises! As it is now, the heat rising from the metal tubes can easily melt the wax in the tubular condensers. By locating vent holes in the bottom of the case, they have managed to insure an even and widespread distribution of melted wax all over the floor mat of the car. We held on to the hope, and we still do while gathering grey hairs, that some smart auto radio engineer would look at the specs of some military or aviation gear and discover that the loctal sockets and tubes have been in use for a long, long time. Perhaps the most "horrible example" in most auto sets is the basic construction of "the thing." Many manufacturers apparently have not been told that vacuum tubes do eventually burn out and need replacement, that vibrator contacts take a terrific beating and will not last forever, and that it would be considerate of the poor (many of them literally) service technicians to employ some common sense engineering in the design of their products.

For example: Mrs. Hotrod goes to the big city in her brand new $4,500.00 1951 convertible and tunes in to see what's cooking with "John's Other Wife." She can guess—but, being a woman, wants to hear someone else admit it. Mrs. Hotrod crosses the railroad tracks at the outskirts of the city at the very moment that John dives out of the window of Apt. 13—then silence. What a climax! Mrs. Hotrod doesn't realize that the tubes in her $85.00 radio hang upside down and that the 6V6GT output tube had shaken loose and dropped from its socket (octal, that is). If her radio used a 7C5 (loctal equivalent) she would have heard John hit bottom. While in town, an auto radio technician begins the tedious job of removing the dash panel trim to get at the retaining bolts holding the auto set. He suspects a tube failure and so states to his customer. Mrs. Hotrod asks, "Do you have to take my car apart just to test the tubes?" Embarrassed, and cursing the radio manufacturer, the technician replies, "Yes, Mam, and I must then pull out the set, place it on my test bench, remove nine stubborn self-tapping screws to remove a tin lid cover. All this just to get at the tubes. If they all test okay and the trouble is under the chassis—then I must remove the other lid by the same stupid process. If one of the buffer resistors under the vibrator is open I will have to heat the hunk of tin with a hot iron to remove another lid in order to reach the components. You see, Madam, the manufacturer of this particular set apparently doesn't give a damn (pardon) how long you or I are tied up in order to fix your radio —no matter how simple the failure.

"In order to make a living I must charge a regular service fee for my service—even though it was just this output tube, which is okay, falling out of its socket as a result of impractical engineering, and a 'pinch penny' technique of using surplus sockets and tubes in an application demanding loctals or some form of tube retainers. And, while I'm in a nasty mood, Mrs. Hotrod, may I point out that it's about time that many radio set makers—television too —consider the problems of maintenance when designing equipment. To be specific—take this set of yours as an example. This is 1951, not 1937, and a well engineered and practical auto radio would include the following:

1. Loctals or miniature tubes with shields to secure the pins in their sockets and, incidentally, a more compact unit as a result.
2. A hinged or removable drop type lid or section held by wing nuts, that would readily expose all tubes.
3. The design of trimmers that are accessible for tuning while the set is mounted in the automobile. Circuits are often thrown out of alignment as mounting bolts are tightened during installation."

The above incident is fictitious to some extent. It does, we are sure, exemplify what must transpire in the minds of the auto radio technician and his customers. . . . . O.R.

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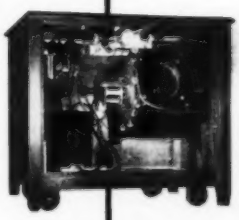
Use with almost any TV set

DUO-VUE connects perfectly to most 10", 12" and 16" TV receivers (fits over 800 models).* Full instructions are provided for easy connection by anyone familiar with radio equipment. Supplied with complete connecting harness for convenient installation.

*Not suited for sets wired with filaments in series, and those using electrostatic deflection or cathode-modulated tubes. If in doubt, write us, giving make and model of your TV set.

Ideal for Clubs, Schools, Churches, Hospitals or Large Group Showings

DON'T MISS THIS SENSATIONAL TV BUY OF A LIFETIME



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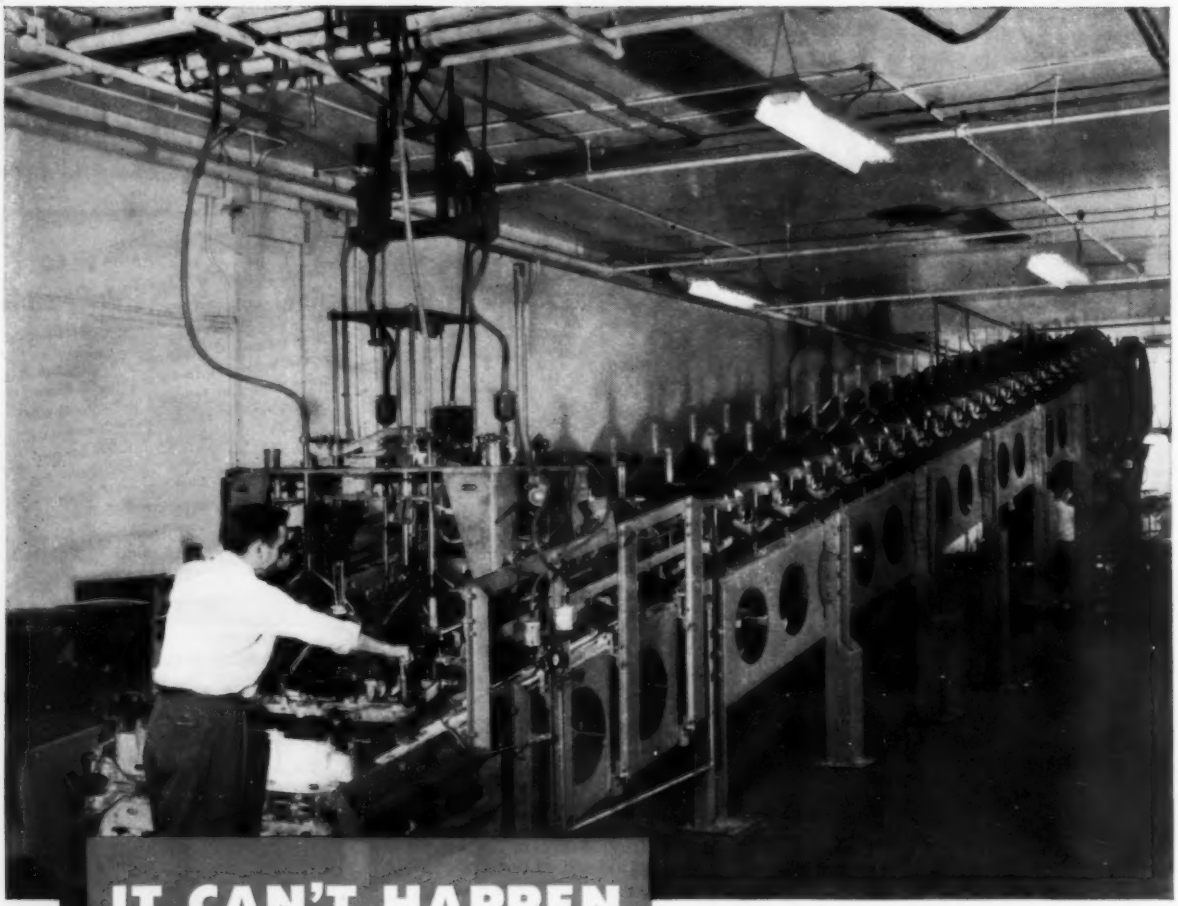

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Get Master Shop-Method Home Training from an Established Practical Resident School with its own Training Shops, Laboratories, and Studios—and almost 50 Years of Successful Experience in Training Ambitious Men.

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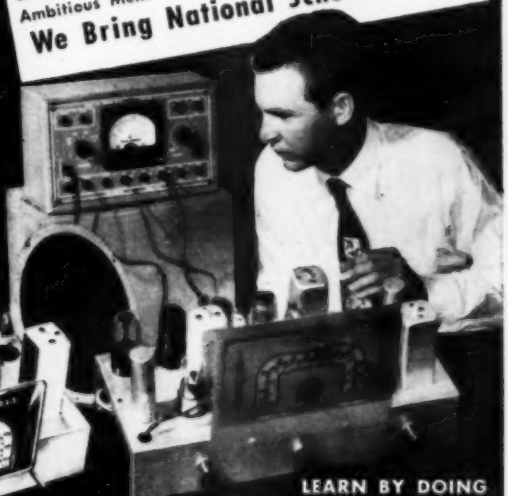

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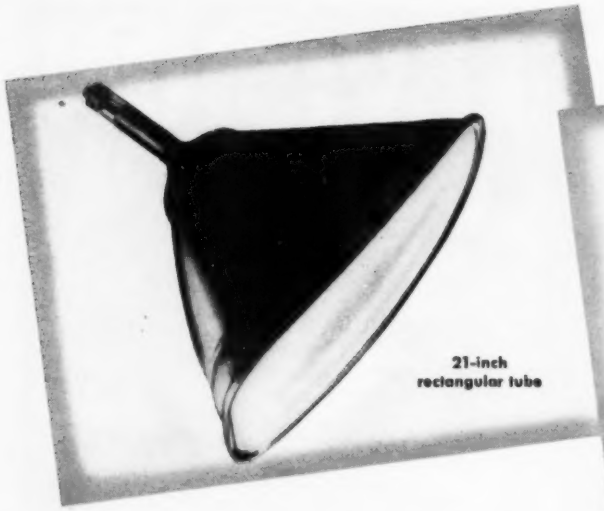

BIGGER PICTURE TUBES

of U·S·S Stainless Steel

are television's big news today

● Here's a display of big-tube television that any dealer could be proud of. And a big assist in the development of today's large-screen television goes to U·S·S Stainless Steel—U·S·S 17-TV.

The use of U·S·S 17-TV Stainless Steel in picture tube shells cuts tube manufacturing costs. Such metal-glass tubes are also stronger and thus safer, less susceptible to implosion. And this special grade of Stainless Steel makes it possible to keep these giant tubes light and compact. With lighter steel shells, considerable time is saved handling tubes on the production line.

Specifically, these Stainless Steel shells reduce tube weights by one-fourth to one-third—highly important in the 21, 24 and 30-inch picture tube range.

Since the face plate is made separately from the shell in metal-glass TV tubes, it can be made from drawn glass having better optical qualities. The clear, sharp pictures that result are in keeping with their "theater-screen" size.

U·S·S 17-TV Stainless Steel—developed especially for television applications—has proved itself the strongest, lightest and safest material for both rectangular and round tubes. These big, new sets . . . the kind of television your customers want . . . deserve your best sales efforts.

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NATIONAL TUBE COMPANY, PITTSBURGH • TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM • UNITED STATES STEEL COMPANY, PITTSBURGH
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2 New Trio Products

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Here, indeed, is the rotator that abolishes TV callback problems!

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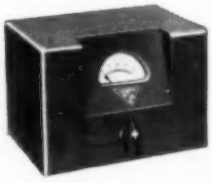
Positive acting electrical stops at both ends of 360° turn eliminates lead damage.



Indicator always shows exact antenna position.

Compare These Features

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- 11/16 steel shaft withstands 4500 lbs. bending movement
- Automatic Electro-Mechanical Brake — reduces coasting to minimum
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- Numbered terminal boards on rotator and indicator
- Turns 1 RPM, lifetime lubricated
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Weighing less than a pound per foot, this sturdy, extremely handsome, all weather-proof triangular tower represents a great refinement in streamlined appearance and installation ease over all others. Its all-aluminum components permit the most flexible arrangements for construction of the *exact* tower needed for *any* installation.

Tower may be raised from horizontal position in heights up to 40 feet. For additional height, sections may be added from *bottom*.

Comes in 5 foot sections, a bottom section, a top section and as many center sections as desired.

Dual Swivel Base 180° and 360°

FEATURES

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- High Quality Extruded Aluminum
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- Preferred Riveted Construction . . . No Welded Joints
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- Low Installation Cost
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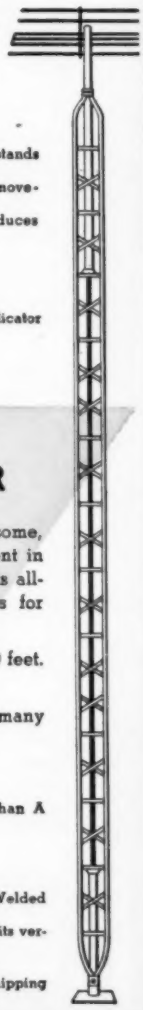

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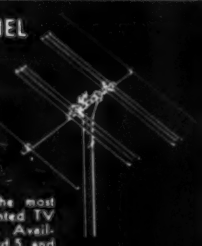
- Sturdy Construction — Light Weight!
- Partially Assembled!

TRIO 2-CHANNEL YAGIS



(Models 445 & 479)

Rapidly becoming the most popular — most wanted TV antenna in America. Available for channels 4 and 5, and channels 7 and 9. Provides gain on two channels equal to any two conventional 4-element yagis!

- Full 10 db Gain On 2 Channels!
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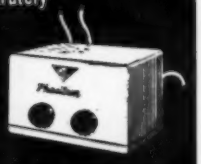
Now available separately

(Model No. PC-600)



The TRIO PHASITRON, originally sold only as part of the TRIO Controlled Pattern TV Antenna System, is now available separately for TV set owners who want to get the very best results from their sets and antennas, or to hams and other experimenters.

PHASITRON acts as a continuously variable tuning stub and will provide an exact impedance match between line and booster and helpful in matching output impedance of booster to set input impedance. Due to exact matching, losses in line become negligible and set performance greatly improved.

May also be used to coordinate input from two or more antennas to provide added balanced output to set. Write for full details.

NEW TRIO TV ACCESSORY CONTROL UNIT

(Model No. RY-1)

A handy control unit that hides away inside or in back of the TV set and provides an automatic line switch for booster, rotator, TV lamp or other accessories. By plugging the line cords from these accessories into the TRIO Control Relay Unit, all accessories are turned on with the one switch controlling the TV set. Quickly installed without making any wiring changes in set.

Trio MFG. CO.
GRIGGSVILLE, ILLINOIS

Dramatic Proof from KOREA!

ACTUAL EXCERPTS OF UNSOLICITED LETTERS FROM SOLDIERS IN KOREA

AMIDONG, KOREA—22 March, 1951:
"... S-72 performed better than expected; we can hear the news each day instead of waiting for the news papers. The radio will pick up Japan easily on standard broadcast or short wave; and on the latter you can get Australia (even in the daytime) Manila, Honolulu, and San Francisco."

KOREA—38th Parallel—3 April, 1951:
"... my S-72 is performing very well. Receive standard broadcast very good at night. I have been able to pick up Tokio and San Francisco almost on that band."

c/o Fleet Post Office,
San Francisco, California, 14 April, 1951:
"... in central Korea, S-72 operates well regardless of location."

hallicrafters S-72

LONG RANGE PORTABLE

The World's Most Powerful Portable

Servicemen the world over are recording a new chapter in performance for Hallicrafters famous S-72. This 8-tube masterpiece of precision engineering features the widest frequency range of any portable made—with *continuous coverage* from 540 kc to 30 Mc.*

PRICE: $109.95 Less batteries. AC/DC or batteries; brown leatherette cabinet. 61-in. whip antenna for short wave; loop for long wave.

*S-72L, for aircraft and marine band reception, $119.95. 175-920 kc plus 540-12.5 Mc.

hallicrafters

"The Radio Man's Radio"

WORLD'S LEADING MANUFACTURER OF *PRECISION* RADIO & TELEVISION • CHICAGO 24, ILL.

CRT TESTER AND CIRCUIT ANALYZER

CHECKS CRT & CRT CIRCUIT IN TV SET

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Reid Distributors Co., Birmingham
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Radio Parts Sales Co., Los Angeles
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Radio Electric Service Co., Baltimore
MASSACHUSETTS
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Hatry & Young, Boston
Hatry & Young, Springfield
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Radio Shack Corp., Boston
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Lifesy Distributing Co., Flint
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Another
OAK RIDGE
Portable "Miniature"
FIRST!

MODEL 101
SUBSTITUTION TESTER

Substitutes 5 paper and 2 electrolytic condensers, 4 resistors, potentiometer, loudspeaker and output transformer.
Size: 5 ¾x4x2 ¼"
Dealers Net—**$17.95**

MODEL 104
SYNCRO-SWEEP GENERATOR

Generates a combination of pulses and sawtooth waves for adjusting or tracing linearity, sync, sweep, and HV circuits. R. F. or mod. output.
Size: 5 ¾x4x2 ¼"
Dealers Net—**$44.50**

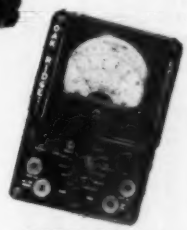
MODEL 106 CRT TESTER

CHECKS:
- High Voltage Breakdown or Leakage
- Gas between elements in Electron Gun
- Gas between High Voltage Anode and Electron Gun
- Conductance between Cathode and Control Grid
- Conductance between Control Grid and Screen Grid
- Filament Continuity
- High Voltage on Anode
- Screen to Control Grid Voltage from set
- Control Grid to Cathode Voltage from set
- Brightness Control Voltage

Size: 5 ½x3 ⅞x2 ¼"
Dealers Net—**$29.95**

MODEL 102
HIGH VOLTAGE METER

10,000 ohms per volt HV meter. D. C. voltages: 0-500V, 15KV, 30KV with 30KV insulated probe.
Size: 5 ¾x4x2 ¼"
Dealers Net—**$17.95**



MODEL 105
20,000 OHM per VOLT MULTITESTER

1% resistors throughout. 6 DC ranges: 0-2.5V-5KV; 6 AC ranges: 2.5V-5KV; 4 current ranges: 100UA-500 MA; 3 resistance ranges: 0-2000-20 meg. Easy to read 3 ½" Multiscalemeter. Size: 5 ½x3 ⅞x3" Dealers Net—**$38.95**

MODEL 103
SIGNAL GENERATOR

Generates a wide range of modulated or unmodulated precision R. F., I. F., and audio-video signals for signal tracing or aligning TV receivers. (54-216 m.c., 20-48 m.c., 4.5 m.c. and 500 cycles).
Size: 5 ¾x4x2 ¼"
Dealers Net—**$33.50**

MODEL 107
DYNAMIC TYPE TUBE TESTER

Complete tube tester supplying plate, screen grid and filament voltages to check all receiving type tubes. 1.4, 2.5, 5, 6.3, 12.6, 18.9, 25, 35, 50 and 117 V filaments. Size: 5 ½x3 ⅞x2 ¼"
Dealers Net—**$49.95**

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And many others, for information write

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manufacturing division of Video Television, Inc.

Spot Radio News

★ ***Presenting latest information on the Radio Industry.***

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

COLORVISION, on a legal and technical rampage for nearly a decade, which it was felt might become quite a docile member of the arts with a popular decision from Washington, has now entered an even more raging stage, in view of the edict from the Supreme Court which favored the Commission's disc ruling, but still applauded the possibilities of compatibility, one of the basic technique factors around which much of the official arguments revolved.

The high court acknowledged that *CBS* had apparently made more rapid progress in developing an acceptable system, but added that their procedure has been attacked on the ground that it was . . . "utilizing old knowledge highly useful in the realm of the physical sciences and mechanical practices, but incongruous in the new fields of electronics occupied by television." Declaring that the latter fact was still a focal objection to the wheel approach, the justices added there was also the serious objection that . . . "existing receiving sets are not constructed in such a way that they can, without considerable adjustments, receive *CBS* color broadcasts, either in color or black and white." This problem, they said, makes the system . . . "incompatible with the millions of television receivers now in the hands of the public."

Noting that a compatible system . . . "would be more desirable" . . . the members of the high tribunal said that . . . "recognition of this fact seems to be the controlling reason why the Commission did not long ago approve the incompatible *CBS* system."

Supporting the Commission's reasons for giving the nod to *CBS*, the court said that the ether-lane cops believed that . . . "the *CBS* system will provide the public with color of good quality, and that television viewers should be given an opportunity to receive it, if they so desire." Such a view, the justices felt was fair, even though . . . "the wisdom of the decision can be contested, as is shown by the dissenting opinions of two Commissioners." However, it was pointed out that . . . "courts should not overrule an administrative decision, merely because they disagree with its wisdom." The implication, in this comment, that some of the justices might have questioned the practical virtues of the Commission's authorization of mechanical huecasting, has become a sizzling topic of debate in many industry circles.

In the decision, which was issued as a majority opinion, there appeared also a statement by Justice Frankfurter, expressing doubts as to the wisdom of legalizing an incompatible system. He intimated that the Commission might have acted too hastily. To his way of thinking, the fixing of standards could tend to eliminate the incentive for improvement.

The justices also appeared to feel that the go-ahead signal did not preclude any further development and cited the report of the FCC to justify this view, a report which declared that the Commission has not closed the door on any experimentation or possible examination of any practical procedure resulting from such study. FCC reemphasized this factor in a special public notice statement on color, stating that . . . "persons with genuine programs of experimentation in the color field may carry on their experiments by securing experimental authorization." And in a subsequent commentary, covering the possibility of a different color system being adopted in the near future, the Commission added that if a proponent reasonably satisfied a criterion, a hearing might be ordered to consider a petition to adopt such a new system: According to the criteria a system should . . . operate within the present band; be capable of producing a picture which has a high quality of fidelity, adequate definition, good picture definition, and is not marred by misregistration, line crawl, jitter, etc.; provide a picture which is sufficiently bright to permit adequate contrast range and which can be viewed under normal home conditions without objectionable flicker; be capable of operating through apparatus that is simple to operate in the home, with no critical registration or color controls, and be cheap enough to be available to the great mass of the public; be capable of operating through equipment at the station that is technically within the competence of the type of trained personnel hired by a station owner who does not have an extensive research or engineering staff at his disposal, while the costs of purchase and maintenance of the equipment must not be so high as to restrict the class of persons who can afford to

CHICAGO, ILL.—Harold W. Chambers, Chambers Radio and Appliance Co., says: "We had to lick call-backs before they licked us. So we made quality tubes a 'must' at Chambers—principally G-E tubes, the brand every serviceman respects. Now TV service shows a steady profit on our books. Consequently, all of us here are strong for General Electric tubes—boost them every chance we get."

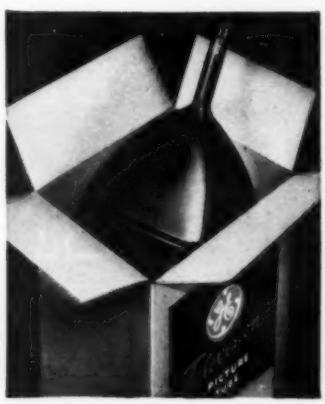
BROOKLYN, N. Y.—Joseph F. Lauinger, President, Conlan Electric Company, says: "Call-backs can wipe out profits. Quality tubes mean fewer call-backs—protect income. That's why, with 40,000 owners on our contract list, we feature G-E tubes. We know that when one of our men installs a G-E picture tube or receiving type, chances are that customer will *stay satisfied!*"

HERE'S PROOF THAT G-E TUBES CUT CALL-BACKS!

WASHINGTON, D. C.—Mike Filderman, Vice-president, Phillips Radio Company, says: "Our call-back expense scared us, for customers' sets kept giving trouble. That was before we standardized on quality tubes—G-E tubes. They've done away with our most common cause of receiver trouble, tube failures. Believe me, that saves plenty, when you're servicing about 15,000 TV sets on yearly contract!"

CINCINNATI, O.-COVINGTON, KY.—Everett Caudill, Manager, Tel-Rad Center, says: "To cut costs, we had to cut call-backs! They tied up our repairmen—wasted valuable working time. The trouble was mostly tube failures. We had to stop that in its tracks—and we did, by going over 100-percent to quality tubes. When we say 'quality tubes' at Tel-Rad Center, we mean, first of all, G-E tubes!"

Thousands of dealers, the country over, echo what these leading servicemen say about G-E tubes . . . For quality tubes to cut down YOUR call-backs, see your General Electric tube distributor today!



GENERAL ELECTRIC

381-XAB

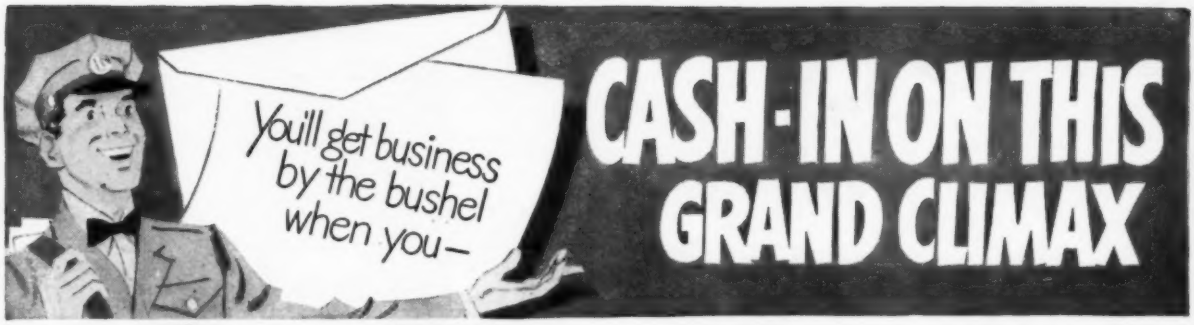
operate a television station; be capable of transmitting color programs over intercity relay facilities presently in existence or which may be developed in the foreseeable future, and the system must not be susceptible to interference, as compared with the present black and white system.

THE COURT ORDER created a flurry of announcements from some accessory and set makers, particularly the recently *CBS*-acquired *Air King* company, who described color equipment which would soon be available and also demonstrated models at shows in Chicago and special trade meetings in New York City. Many chassis producers declared that they would not produce color sets, one nationally-known manufacturer pointing out that the whirling-disc system is bound to be superseded within a short space of time by a compatible type setup.

Color thunder also roared in other quarters of Washington, as representatives of five manufacturers and a lab (*DuMont, General Electric, RCA, Philco, Sylvania,* and *Hazeltine*), serving as members of a National Television System Committee, declared that there has been evolved a composite color system which should provide a highly acceptable picture. In a comprehensive report, these specialists offered a group of proposed standards for the new method which stipulated that . . . picture information can be transmitted by means of a color subcarrier modulated in amplitude and phase with respect to a reference subcarrier of the same frequency, the color subcarrier being transmitted simultaneously with the video signal and during only the video portion of the composite signal. In addition, the sync signals, required to transmit information concerning the reference subcarrier, are to be sent only during the sync and blanking intervals of the composite video signal. To insure practical invisibility of the color subcarrier, it was said that the system requires that the normal frequency, but not phase, of the subcarrier must be an odd multiple of half the horizontal scanning frequency. The color sync signals are to be transmitted by means of a burst of the reference carrier superimposed on the back porch following each horizontal sync pulse.

The committee was of the opinion that the foregoing standards were entirely practical and they provided a sound framework within which the whole TV industry could conduct further testing of high-quality compatible color TV. As a result of this further and detailed testing of the operation of the standards and required equipment, it was expected that numerical values for the standards might be defined shortly by industry. According to the group, it was also expected that those desiring to participate in the design and manufacture of color receiving and transmitting gear would conduct their own product tests, utilizing

(*Continued on page* 98)



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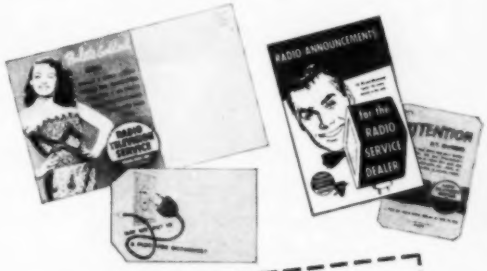
Now begins the second half of Sylvania's greatest and most appealing ad campaign ever offered to Service Dealers.

Featuring 2 famous celebrities, Paulette Goddard and Patrice Munsel, this campaign ties in with big ads soon to appear in the Saturday Evening Post, Look, Life, and Collier's magazine, and is backed by the nation-wide weekly TV show, "Beat the Clock."

Everything included

Here's everything you need for a record harvest of fall service business. You get big, smashing life-like displays of the famous stars. You get counter cards, streamers, direct-mail pieces . . . even radio spot announcements.

Remember, you pay only one cent each for the mailing pieces. All the rest is FREE! So don't let another minute go by without calling your nearest Sylvania distributor . . . or mail the coupon NOW.



SYLVANIA

RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT TUBES, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

SYLVANIA ELECTRIC PRODUCTS INC. 1901–1951 FIFTY YEARS 50th ANNIVERSARY FIVE DECADES OF PROGRESS

Sylvania Electric Products Inc.
Dept. R-2108B, Emporium, Pa.

Please send me full details about Sylvania's great Fall 1951 Service Dealer Campaign.

Name_____

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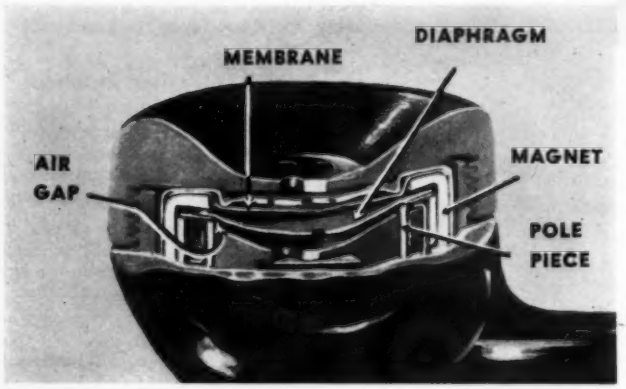
City_____ Zone____ State_____

Easy on the ear



More naturally than ever, your voice comes to the ear that listens through the latest telephone receiver developed at Bell Telephone Laboratories. The reason: a new kind of diaphragm, a stiff but light plastic. Driven from its edge by a magnetic-metal ring, the diaphragm moves like a piston, producing sound over all of its area. Effective as are earlier diaphragms of magnetic-alloy sheet, the new one is better, gives more of the higher tones which add that personal touch to your voice.

To work the new receiver, telephone lines need deliver only one-third as much power. So finer wires can do the job. This is another new and important example of the way scientists at Bell Telephone Laboratories work to keep down the cost of telephone service, while the quality goes up.

BELL TELEPHONE LABORATORIES

WORKING CONTINUALLY TO KEEP YOUR TELEPHONE SERVICE ONE OF TODAY'S GREATEST VALUES

FREE

MONEY MAKING FCC Commercial Radio Operator LICENSE INFORMATION

TELLS HOW—

WE GUARANTEE

TO TRAIN AND COACH YOU AT HOME IN SPARE TIME UNTIL YOU GET

YOUR FCC LICENSE

If you have had any practical experience—Amateur, Army, Navy, radio repair, or experimenting.

TELLS HOW—

OUR AMAZINGLY EFFECTIVE JOB-FINDING SERVICE HELPS CIRE STUDENTS GET BETTER JOBS. HERE ARE JUST A FEW RECENT EXAMPLES OF JOB-FINDING RESULTS:

GETS FIVE JOB-OFFERS FROM BROADCAST STATIONS

"Your 'Chief Engineer's Bulletin' is a grand way of obtaining employment for your graduates who have obtained their 1st class license. Since my name has been on the list I have received calls or letters from five stations in the southern states, and am now employed as Transmitter Engineer at WMMT." Elmer Powell, Box 274, Sparta, Tenn.

GETS CIVIL SERVICE JOB

"I have obtained a position at Wright-Patterson Air Force Base, Dayton, Ohio, as Junior Electronic Equipment Repairman. The Employment Application you prepared for me had a lot to do with me landing this desirable position."
Charles E. Loomis, 4516 Genesee Ave., Dayton 6, Ohio

GETS JOB WITH CAA

"I have had half a dozen or so offers since I mailed some fifty of the two hundred employment applications your school forwarded me. I accepted a position with the Civil Aeronautics Administration as Maintenance Technician. Thank you very much for the fine cooperation and help your organization has given me in finding a job in the radio field." Dale E. Young, 122 Robbins St., Owosso, Mich.

TELLS HOW—

EMPLOYERS MAKE JOB OFFERS LIKE THESE TO OUR GRADUATES EVERY MONTH!

Telegram, August 9, 1950, from Chief Engineer, Broadcast Station, Pennsylvania, "Have job opening for one transmitter operator to start immediately, contact me at once."

Letter, August 12, 1950, from Dir. Radio Div. State Highway Patrol, "We have two vacancies in our radio Communication division. Starting pay $200; $250 after six months' satisfactory service. Will you recommend graduates of your school?"

Letter, August 24, 1950, from radio-television sales and service company, Ohio, "We are in need of a good television man. The pay will be good, also good surroundings to work in. Please let us hear from you."

These are just a few of the examples of the job offers that come to our office periodically. Some licensed radioman filled each of these jobs; it might have been you!

Ours is the only home study course which supplies FCC-type examinations with all lessons and final tests.

ACT NOW! Get All 3 FREE

Your FCC ticket is Always Recognized in All Radio Fields as Proof of Your Technical Ability.

HERE'S PROOF FCC LICENSES ARE OFTEN SECURED IN A FEW HOURS OF STUDY WITH OUR COACHING AT HOME IN SPARE TIME:

Name and Address	License	Lessons
Lee Worthy, 2210½ Wilshire St., Bakersfield, Cal.	2nd Phone	16
Clifford E. Vogt, Box 1016, Dania, Fla.	1st Phone	20
Francis X. Foerch, 38 Beucler Pl., Bergenfield, N. J.	1st Phone	38
S/Sgt. Ben H. Davis, 317 North Roosevelt, Lebanon, Ill.	1st Phone	28
Albert Schoell, 110 West 11th St., Escondido, Cal.	2nd Phone	23

CLEVELAND INSTITUTE OF RADIO ELECTRONICS
Desk RN-32, 4900 Euclid Bldg., Cleveland 3, Ohio
(Approved for Veteran Training Under "GI Bill of Rights")

MAIL COUPON NOW

Cleveland Institute of Radio Electronics
Desk RN-32—4900 Euclid Bldg.,
Cleveland 3, Ohio
(Address to Desk No. to avoid delay.)

I want to know how I can get my FCC Ticket in a minimum of time. Send me your FREE booklet, "How to Pass FCC License Examinations" (does not cover exams for Amateur License), as well as a sample FCC-type exam and the amazing new booklet, "Money-Making FCC License information."

Name .....

Address .....

City..... Zone..... State.....

Paste on penny postcard or send air mail.

HARVEY RADIO CO. Elected "Jobber of the Year" for the Metropolitan New York Region . . . . .

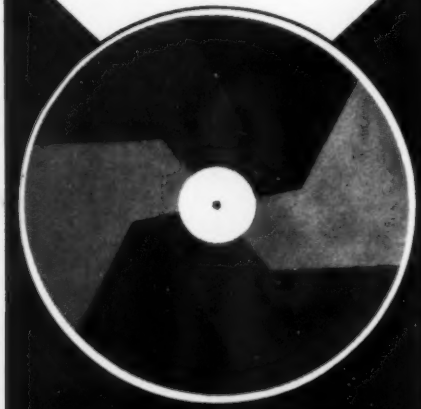
"In recognition of unfailing efforts in the interest of the Electronics Industry at large, for ethical business practices . . . and consistent service to customers," the Harvey Radio Co. has been named Winning "Jobber of the Year" for the Metropolitan New York region by the *Parts Jobber Magazine.*

This is an Award not easily given . . . you have to be good to get it. Harvey customers number in the thousands . . . all over the world. They know that they can depend upon us for service, values, and the things they want when they need them. Whether you are a broadcaster, an amateur operator, a manufacturer, part of a municipality, or are in Civilian Defense . . . you can be sure if you BUY IT FROM HARVEY.

IN STOCK

Famous "CELOMAT" COLOR WHEEL

For color television on your present TV receiver!



Approved by CBS to receive their color as transmitted. When rotated at 1440 R.P.M. in front of any existing TV receiver up to 10 inches, it will bring color television right into your home, providing the set has been converted for color reception. Outside dimensions 22½ inches. Get yours now . . . be the first to receive color TV in your community . . . and, as usual, HARVEY is among the first to make it possible.

Low Priced at Only **$16.95**

COLOR CONVERSION MANUAL

Tells you how to convert your set for color reception . . . . . **Only $1.00**

"We are proud of your company for achieving this recognition" — Mr. Harry Kalker, Sales Manager, Sprague Products Company.

"...a timely recognition for the splendid jobbing job you've done" — Mr. Charles Golenpaul, Sales Manager, Distributor Division, Aerovox Corporation.

"...you can well be proud of the outstanding job you have done" — H. F. Bersche, Manager, Renewal Sales, Radio Corp. of America.

"...a tribute to your fine record of service to the industry" — Mr. Edward Finkel, Sales Manager, JFD Manufacturing Co.

"...your selection as the 'Jobber of the Year for the Metropolitan region' speaks highly for you and your staff" — Jerome E. Respess, President, La Pointe-Plascomold Corporation.

"Your award...proves that good deeds and honest leadership are still the seeds of progress" — Larry Epstein, Sales Manager, University Loudspeakers, Inc.

These are only a few excerpts from letters received from leading manufacturers. You, too, will like doing business with HARVEY.

Telephone: LUxemburg 2-1500

HARVEY RADIO COMPANY INC.

103 West 43rd St., New York 18, N. Y.

You're Out, Pop!

The New RAYTHEON TV Picture Tube Warranty Policy Fans Father Time for Distributors and Service Dealers

RAYTHEON TELEVISION PICTURE TUBES are warranted for *6 months from the date they are installed in the customer's Television set!*

This means that a Raytheon Tube Distributor or Service Dealer can stock Raytheon Picture Tubes now without fear that the warranty will expire while the tube is in stock.


RAYTHEON TELEVISION PICTURE TUBE
WARRANTY REGISTRATION

Tube Type _____ Tube Serial No. _____
Date Installed _____ Set & Model _____
Dealer _____
Address _____
Purchaser _____
Address _____

DEALER NOTE: Protect your customer by registering this warranty. Unregistered tubes are warranted from date of manufacture instead of installation date.

HERE'S HOW THIS EASY TO USE RAYTHEON TUBE WARRANTY POLICY WORKS!

Upon installation, a Tube Warranty Registration card (see picture) is filled out and mailed to RAYTHEON. That's all the Dealer has to do. RAYTHEON records the necessary data and mails a Tube Registration Certificate to the user. Tubes in use less than 6 months failing to give satisfactory service are returned to RAYTHEON with the warranty certificate and receive immediate adjustment.

Add this simple, easily operated Tube Warranty Policy to the superior quality of Raytheon Television Picture Tubes and you'll readily realize why the combination means *no more tube warranty trouble for you.*

Right for Sight!

RAYTHEON

Excellence in Electronics

RAYTHEON MANUFACTURING COMPANY
Receiving Tube Division
Newton, Mass., Chicago, Ill., Atlanta, Ga., Los Angeles, Calif.

RADIO AND TELEVISION RECEIVING TUBES, CATHODE RAY TUBES, SPECIAL PURPOSE TUBES, SUBMINIATURE TUBES, MICROWAVE TUBES

Within the INDUSTRY

WALLACE R. MacGREGOR, formerly common-carrier engineer on the staff of the FCC, has joined *Lenkurt Electric Sales Co.* as manager of government sales for carrier telephone and telegraph systems. He will head two new branch offices in Washington, D. C. and Monmouth County, New Jersey.

During the war Mr. MacGregor served with the Navy on the engineering of land-line communications installations for both continental and advance base naval shore establishments.

Previously he held various plant supervisory posts with the *New York Telephone Co.* He is a graduate of Clarkson College of Technology, is a registered engineer in the state of Maryland, and a member of the IRE and AFCA.

* * *

GENERAL ELECTRIC COMPANY has presented a $90,000 television transmitter to the University of Illinois, according to an announcement made by George D. Stoddard, president of the university.

The transmitter will be located at the university's Robert Allerton Park, about 25 miles from the main campus where the studio facilities will be erected.

Final channel allocation is not expected until some time this fall.

* * *

W. C. CONLEY, JR. has been named vice-president and manager of branches of the *Crosley Distributing Corporation,* the wholly-owned subsidiary of the *Crosley Division* of *Avco Manufacturing Corporation* . . . **GERALD GANLEY** is the new director of purchases for *Freed Radio Corporation* of New York . . . **JAY E. BROWDER** has been appointed chief of the radio communications engineering section of *Kollsman Instrument Corporation,* a subsidiary of *Standard Coil Products Co., Inc.* . . . **LEON HILLMAN,** formerly of New York University's Research Division, has been named to head the engineering department of *Production Research Corporation* of Thornwood, New York . . . **ALBERT J. ROSEBRAUGH** has been appointed to the newly-created post of manager of distribution for *Philco Corporation* . . . **DR. HENRY G. BOOKER** and **JOHN M. BERKOWITZ** have been elected to the board of directors of *The LaPointe-Plascomold Corporation.* Dr. Booker, a professor of engineering at Cornell University and a leading authority on wave propagation, also acts in an advisory capacity to the company . . . **BILL CAMERON** has been named general manager of *Concord Radio Corp.'s* operations . . . **OVID RISO,** advertising and sales promotion manager of *Philco International Corporation,* has been appointed vice-president in charge of advertising . . . **N. J. MacDONALD** has been named vice-president in charge of operations for *Thomas & Betts Co.* of Elizabeth, New Jersey . . . **JOHN F. LORBER,** formerly associated with *Raytheon* and *RCA Institutes, Inc.,* has joined the staff of *Hycor Company, Inc.,* as chief engineer . . . **EDMUND C. BERKELEY** has been elected to the board of directors of *Video Corporation of America* . . . **FRED GOSSARD** has been named sales manager of *Alprodco, Inc.* of Kempton, Indiana . . . **PETER H. COUSINS,** who has been with the headquarters staff of Radio-Television Manufacturers Association since 1946, has been named director of information for the association . . . **JANE DRUCKER,** who for the past three years has served as public relations counsel to "The Representatives," retired on July 15th. "The Representatives" have established national headquarters at 600 S. Michigan Avenue, Chicago 5, Illinois . . . **DICK MITCHELL** has been named sales manager of *Radio Apparatus Corporation* of Indianapolis . . . **WILLIAM P. LEAR,** chairman of the board of *Lear, Inc.,* was awarded an honorary degree of Doctor of Engineering by the University of Michigan in recognition of "his tremendous contribution to aviation communication and aircraft stabilization research and development" . . . **LEO G. SANDS** is the new director of public relations and advertising for *Bendix Radio.*

* * *

T. KEVIN MALLEN has been elected chairman of the board of directors of *Ampex Electric Corporation* of San Carlos, California.

He joined the organization in 1949 and has served as general manager in reorganizing the manufacturing and marketing phases of the company's magnetic tape recorder business.

A native of Ireland, Mr. Mallen was for many years connected with *International Business Machines Corporation* as general manager of its Far Eastern operations.

In addition to his *Ampex* post, he is a managing partner of *Ayala Corporation,* and president of the Peninsula Symphony Association. During the

GET THIS REVISED *up-to-the minute* TUBE MANUAL *NOW!*

Offers complete reliable tube data . . . required by radio and television technicians and electronics engineers.

In these days of television, new tube types are introduced nearly every week. Here at last is a tube manual that will keep you always up-to-date.

It's the 8th edition of Sylvania's famous "Technical Manual" in the same convenient 5½" x 9½" size BUT WITH A BRAND NEW PLASTIC FIBER COVER AND SNAP-OPEN LOOSE-LEAF BINDING.

More than 80 new tube types have already been added to this new 8th edition, including all current TV picture tubes.

Typical pages show tube base diagrams, give physical specifications, ratings, typical operation data and curves, application and design details. Tubes listed in numerical order for quick, easy reference.

Bound in durable plastic

New, convenient loose-leaf plastic binder enables this manual to open easily and lie flat on your bench. Quick, snap-open feature permits insertion of additional data sheets. These sheets... already punched for your book ...are periodically mailed to you FREE as inserts in "Sylvania News," Sylvania's free monthly magazine.

Your Sylvania Distributor has these Manuals *NOW*. Get your copy from him today or mail the coupon with $2.00 for each copy ordered.

Here are just a few of the New Tube Types added to the 1951 Manual

OA3	6AS6	6BG7	25W4
IN60	6AX6	12AU7	1274
5AX4	6BA5	12BN6	5642
6AB4	6BF7	19BG6	5692
6AJ5	6BQ7	25AU5	5719

SYLVANIA ELECTRIC PRODUCTS INC. 1901–1951 50th ANNIVERSARY FIVE DECADES OF PROGRESS

SYLVANIA

Sylvania Electric Products Inc.
Department R-2108A
Emporium, Pa.
Enclosed please find $2.00 for a copy of the new Sylvania Technical Manual.

*Name*_____

*Street*_____

*City*_____ *Zone*____ *State*_____

RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT TUBES, FIXTURES, SIGN TUBING, WIRING DEVICES· LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

war he served as chief of S.E. Asia Branch for G-2, General Staff, Washington, D. C.

* * *

WILLIAM T. BUSCHMANN has been named merchandising coordinator for the Radio Tube and Television Picture Tube Divisions of *Sylvania Electric Products Inc.*

He was formerly associated with the *Socony-Vacuum Oil Co., Inc.*, as assistant to the Foreign Trade Industrial Relations advisor, coordinating sales training and salary administration programs.

During World War II, he served as a patrol bombing pilot in the ETO. He did experimental work with electronically controlled target drones and attended the Anti-Submarine Electronic Development Project School at Quonset Point, R. I.

Mr. Buschmann is an associate member of the IRE and holds an unlimited commercial pilot's license.

* * *

ROBERT C. SPRAGUE, president of the *Sprague Electric Company,* was re-elected chairman of the board of directors of the Radio-Television Manufacturers Association at that organization's 27th annual convention.

The board of directors also re-elected Leslie F. Muter as RTMA treasurer for his 16th term and renamed Dr. W. R. G. Baker as director of the engineering department. James D. Secrest was retained as secretary and general manager while John W. Van Allen was reappointed general counsel.

Two new directors were named to the board; Robert S. Alexander, president of *Wells-Gardner & Co.*, and Harlan B. Foulke, vice-president and director of sales of *Arvin Industries, Inc.*

* * *

THE BELL SYSTEM has made application for permission to expand microwave radio relay facilities in the Upper New York State area, including construction of a new link between Syracuse and Rochester.

On completion, the expanded system would provide a total of six broadband radio relay channels between Albany and Buffalo, four of which would be reserved for long distance telephone message service and two for television transmission.

* * *

HENRY T. ROBERTS has been appointed vice-president of *Majestic Radio & Television,* Division of *The Wilcox-Gay Corporation.* He will be in charge of the private-brand contract sales department and will also act as sales manager for *Wilcox-Gay* recording products.

During the past 10 years Mr. Roberts has been a free lance manufacturers' sales representative. As executive vice-president of the *J. P. Seeburg Corporation,* from 1937 to 1941, he participated in the introduction of the first illuminated coin phonograph. From 1930 to 1933, he served as vice-president and director of sales for the *U. S. Radio & Television Corporation.*

He will maintain headquarters at *Majestic's* Chicago offices, 743 N. La Salle Street, and at Charlotte, Michigan.

* * *

HELDOR MANUFACTURING CO. has been organized to manufacture products formerly produced by **HELDOR METAL PRODUCTS CORPORATION.** The new firm has leased space in the industrial building at 225 Bloomfield Avenue, in Bloomfield, New Jersey . . . Formation of a wholly-owned subsidiary, the **CANADIAN WESTINGHOUSE SUPPLY COMPANY,** to distribute the products of the **CANADIAN WESTINGHOUSE COMPANY, LTD.,** has been announced . . . **WILKOR PRODUCTS, INC.,** of Cleveland, Ohio, manufacturers of precision resistors, has been acquired by **AEROVOX CORPORATION.** The present management of the subsidiary will continue to operate the firm . . . A new corporation, **WARSAW PRODUCTS, INC.,** has been organized in Warsaw,

(*Continued on page* 104)

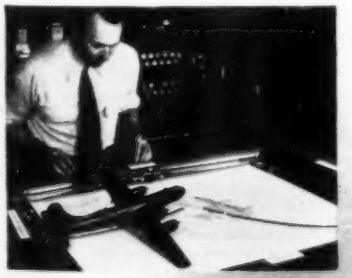
They "test-fly" rockets for pennies —to save the taxpayer Millions

One way to make America stronger is to give our Armed Forces more and better weapons—built without wasting the nation's defense dollars. An example how this can be done is seen in our vital *guided missiles program.*

Using an electronic calculator—an analogue computer developed by RCA Laboratories for the U. S. Navy—the designs of guided missiles can now be tested in the drawing board stage, to save time and money. Information representing the rocket's design is fed into RCA's calculator. Other information represents flight conditions, and the two are then combined to show how the rocket performs . . . at any split second.

Millions of defense dollars – thousands of hours—are saved by these mathematical "test flights." And RCA's calculator will test any man-made device that flies or swims . . . planes, ships, bullets, shells, rockets, submarines.

See the latest in radio, television, and electronics at RCA Exhibition Hall, 36 West 49th St., N. Y. Admission is free. Radio Corporation of America, RCA Building, Radio City, New York 20.



Models of guided missile and bomber about to meet on the plotting board of RCA's computer.

New electronic computer at RCA Laboratories "test-flies" rockets before they are built.

RADIO CORPORATION of AMERICA

World Leader in Radio—First in Television

PRICES Slashed

SAVE UP TO 50% during GIGANTIC CLEARANCE SALE of USED TEST and COMMUNICATION EQUIPMENT

OUR $50,000 STOCK OF RECONDITIONED, "GOOD-AS-NEW" EQUIPMENT MUST GO AT A RECORD-BREAKING SACRIFICE TO MAKE ROOM FOR NEW MERCHANDISE!

All instruments thoroughly checked and guaranteed to be in normal operating condition when shipped. While the following is only a partial list of our huge inventory (available at the time this publication goes to press) *bargains like these simply can't last*! So act now and avoid disappointment. Wire, write, phone or use the handy coupon *today*! When ordering, indicate first, second and third choice. All merchandise subject to prior sale.

COMMUNICATION EQUIPMENT

Babcock P2A Preselector	$ 22.50
Breting 9 Receiver & Spkr.	25.00
Breting 12 Receiver & Spkr.	49.50
Collins 75A1 Recvr & Spkr.	299.50
Collins 75A Recvr & Spkr.	275.00
Gon-Set 10 meter converter	21.95
Gon-Set 20 meter converter	21.95
Gon-Set Noise Clipper	7.50
Hallicrafter HT9 Transmitter	225.00
Hallicrafter HT18 VFO	89.50
Hallicrafter SX28 & Spkr.	119.50
Hallicrafter S38	32.50
Hallicrafter S38A	34.50
Hallicrafter S38B	42.50
Hallicrafter S40A	59.50
Hallicrafter S47 less spkr.	109.50
Hallicrafter SX62 less spkr.	229.50
Hallicrafter SX71 less spkr.	159.50
Hallicrafter S19R	27.50
Hallicrafter S20R	44.50
Hallicrafter SX24 & Spkr.	67.50
Hallicrafter SX25 & Spkr.	79.50
Hallicrafter SX43 less spkr.	134.50
Hallicrafter S53	50.00
Hallicrafter S72 Portable	79.50
Hammarlund HQ120 & Spkr.	79.50
Hammarlund HQ129X & Spkr.	139.00
Howard 440H & Spkr.	49.50
Johnson Viking—Wired	250.00
Jones Micromatch MM 1	14.95
Meck T60-1 Transmitter	79.50
Meissner 9-1090 Shifter	54.50
Meissner EX Signal Shifter	49.50
Millen 90800 Exciter	24.00
National HFS less P. S.	89.50
National HR05TA1 PS SPK COILS	175.00
National HR07 PS SPKR COILS	219.50
National HR07R PS SPKR COILS	229.50
National NC173 & Spkr.	137.50
National NC183 & Spkr.	209.50
National NC240D & Spkr.	129.50
Pierson KP81 & Spkr.	199.50
RME HF10-20	59.00
RME 45 with spkr	95.00
RME 45A with spkr.	99.50
Simpson 380 Wavemeter	29.50
Sonar AMP50	29.50
Sonar XE10	14.95
Sonar VFX 680	39.50
Surplus BC224 110V ac no spkr.	49.50
Surplus BC312 110V ac no spkr.	49.50
Sylvania Modulation Ind.	19.50
Telvar T60-2	109.50
Transmeter Wave Meter	19.50

TEST EQUIPMENT

TUBE TESTERS

Precision 912	$ 27.50
Supreme 589	22.50

TUBE TESTER COMBINATIONS

Precision 954G	42.50
Supreme 599	29.50

VOLT-OHM-MILLIAMMETERS

Precision 856G	27.50
RCP 492	32.50
Simpson 240	17.50
Simpson 390	22.50
Triplett 666H	15.00
Weston 785	67.50

AUDIO OSCILLATORS

Jackson 652	59.50
RCA 154	32.50

SIGNAL GENERATORS

Eico 360	32.50
McMurdo Silver 906	59.50
Precision E200	42.50

VTVM

Heathkit Wired	27.50
Hickok 203	64.50
Hickok 4800S	42.50
McMurdo 900 VOMAX	29.95
Precision EV10S	49.50
RCP 662	27.50
RCP 663A	29.50
RCP 664	32.50
Triplett 2450	59.50
Triplett 2451	69.50

ANALYZERS

Hickok 156	99.50
Meissner Analyst	57.50
RCA Rider Chanalyst	89.50

CONDENSER CHECKERS

Cornell Dubilier BF50	29.50
Solar CB series	27.50

OSCILLOSCOPES

Clough Brenqle CRA	37.50
Hickok RF04	50.00
Hickok 305	89.50
Hickok 505	139.50
RCA 155	47.50
RCA TMV122B	25.00

Special Used Sound Equipment

Pentron 748 Wire Recorder-Radio-Phone	$ 69.50
Twin Trax Tape Recorder	159.50
Webster 80 Wire Recorder with mike	69.50

SPECIAL: Presto Model Y Recorder, never used in original carton. Brand new, net $771.00. Our special price (1 only) $550.00

SPECIAL: Presto Model PT-900 professional tape recorder. Store demonstrator. In brand new condition. Guaranteed. Regular net $799.00 (1 only) $689.50

Walter Ashe Radio Co. R-51-8
1125 Pine St., St. Louis 1, Missouri

☐ Rush my order for Used Equipment as follows:
(1st choice) .....
(2nd choice) .....
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☐ Remittance for $.....is enclosed.
☐ Send FREE List of Additional Used Equipment Bargains.

Name .....
Address .....
City..... Zone..... State.....

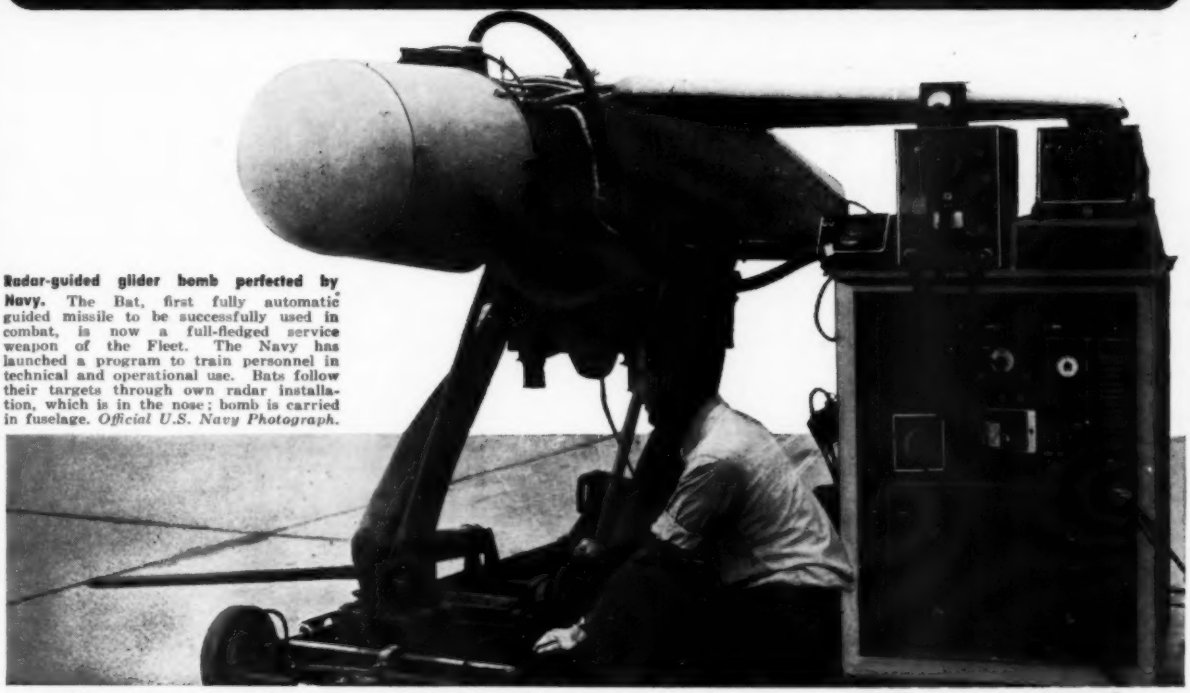
FREE!

Send for free catalog and complete list of used test and communication equipment bargains.

All prices F.O.B. St. Louis Phone: CHestnut 1125

Walter Ashe RADIO CO.
THE HOUSE OF "SURPRISE" TRADE-INS
1125 PINE ST. • ST. LOUIS 1, MO.

Your Own Secret Weapon is Electronic Training!



Radar-guided glider bomb perfected by Navy. The Bat, first fully automatic guided missile to be successfully used in combat, is now a full-fledged service weapon of the Fleet. The Navy has launched a program to train personnel in technical and operational use. Bats follow their targets through own radar installation, which is in the nose; bomb is carried in fuselage. *Official U.S. Navy Photograph.*

Whether in the Armed Services or Industry, CREI Home Study Pays off with More Money . . . Interesting Jobs . . . Secure Careers

Electronics in war directs gunfire, drops bombs, finds enemy planes, "homes" friendly planes, detonates explosives, and finds targets. Any man with electronics training gets an important berth in the Services. Just as essential to television and the entire electronics industry, the man with advanced electronics know-how is assured of an interesting, well-paid career.

CREI, through home study, offers practical technical training, starting with basic principles. It grounds you thoroughly in the fundamentals required for work in guided missiles, television, and all the important fields of communications and electronics. Thus, with CREI training you qualify for work in an industry that desperately needs qualified men. Or if you enter the armed services, your electronics knowledge puts you in line for promotion.

In World War II CREI trained thousands of men for the Services. In recent years CREI has been selected by major airlines, manufacturers, networks and top merchandisers to train their own electronics specialists. United Air Lines, Pan American Airways, Canadian Broadcasting Corp., Bendix, RCA Victor, and Sears-Roebuck are just a few of the firms that have paid us to train their men.

Make your own opportunity in electronics. Start preparing at once while there is still time! The next few months can be all-important in determining your future electronics career. Write immediately for complete information. The cost is within reach of all, the terms easy.

THE THREE BASIC CREI COURSES:

★ **PRACTICAL RADIO ENGINEERING**
Fundamental course in all phases of radio-electronics

★ **PRACTICAL TELEVISION ENGINEERING**
Specialized training for professional radiomen

★ **TELEVISION AND FM SERVICING**
Streamlined course for men in "top-third" of field

ALSO AVAILABLE AS RESIDENCE SCHOOL COURSES

CAPITOL RADIO ENGINEERING INSTITUTE

An Accredited Technical Institute Founded in 1927

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Dept. 118C, 16th & Park Road, N. W., Washington 10, D. C.

Gentlemen: Send booklet, "Your Future in the New World of Electronics," together with details of your home study training. CREI self-improvement program and outline of course. I am attaching a brief resume of my experience, education and present position.

Check the Field of Greatest Interest:

- ☐ Practical Television Engineering.
- ☐ Practical Radio Engineering.
- ☐ TV, FM & Advanced AM Servicing.
- ☐ Aeronautical Radio Engineering.
- ☐ Broadcast Radio Engineering (AM, FM, TV).

If Residence School in Wash., D. C., Preferred, Check Here ☐

NAME.....AGE.....

ADDRESS.....

CITY.....ZONE.....STATE.....

Sensationally NEW for 1952!

MIDWEST TELEVISION

A Magnificent New Line of *Beautiful* CONSOLES and Complete CHASSIS *featuring This MAMMOTH* 20-Inch Rectangular PICTURE TUBE

EASY TERMS FACTORY-TO-YOU

Powerful 20-Inch MIDWEST TELEVISION CHASSIS For Easy Installation In Your Own Cabinet

"CONSTELLATION" 20-Inch Television Console

Video Grand

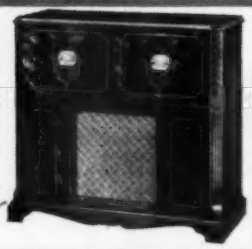
20-Inch TELEVISION-RADIO-PHONOGRAPH CONSOLE

A luxurious instrument that offers the Mammoth 20-Inch Rectangular Picture Television, plus powerful AM-FM Radio, plus 3-Speed Automatic Intermix Record-Changing Phonograph in a beautiful mahogany veneer console.

Also—Powerful New 1952 World-Ranging MIDWEST Series of RADIOS

For Beautiful Consoles and Complete Chassis

An entirely new line of radios featuring the powerful Series 16 five wave band AM-FM Radio Chassis and the magnificent Symphony Grand Radio-Phonograph with 3-Speed Automatic Intermix Record Player.



Easy Terms

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WRITE or PHONE For This *NEW* 1952 FREE MIDWEST TELEVISION RADIO CATALOG

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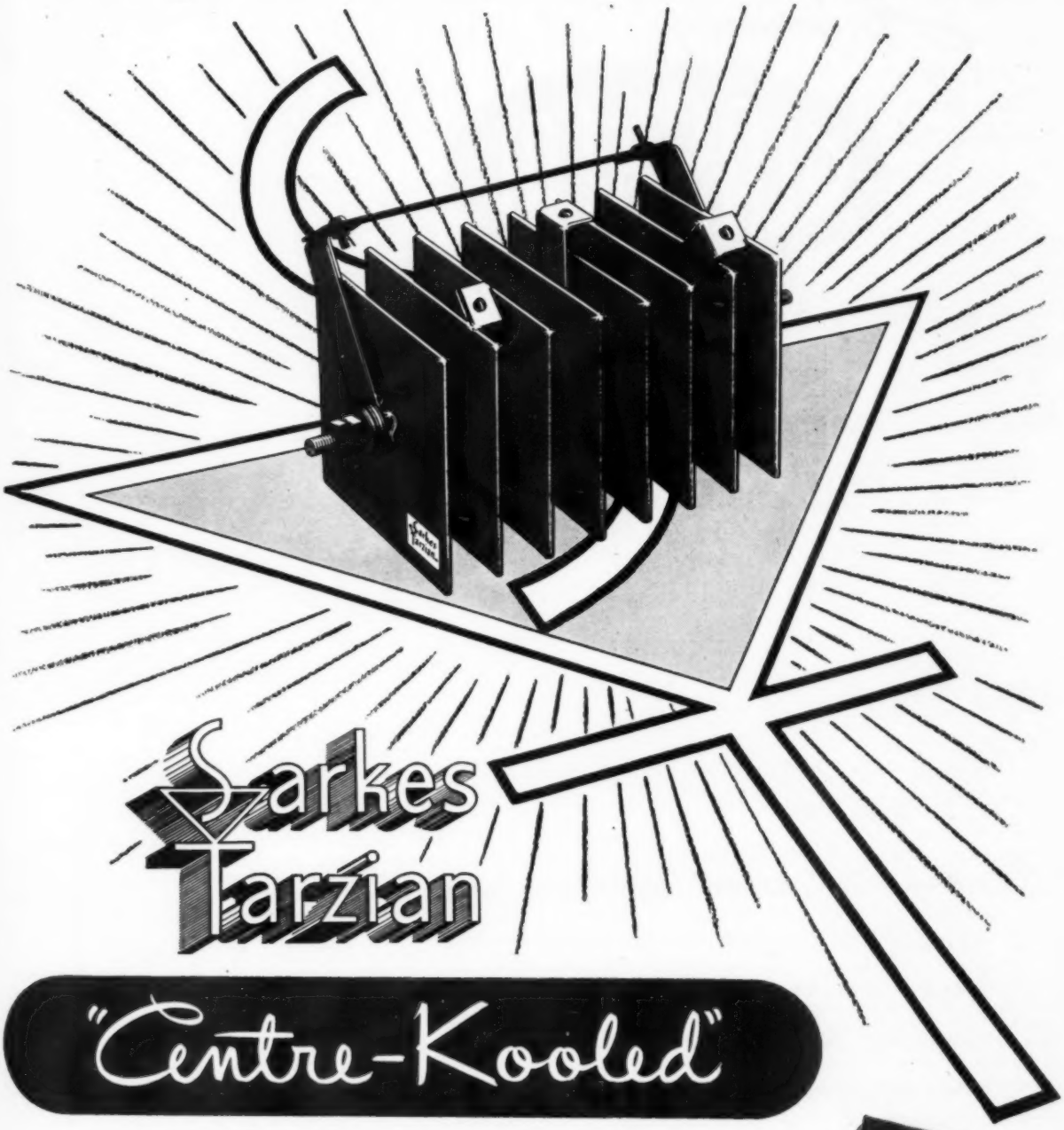
Dependable Power



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SELENIUM RECTIFIERS

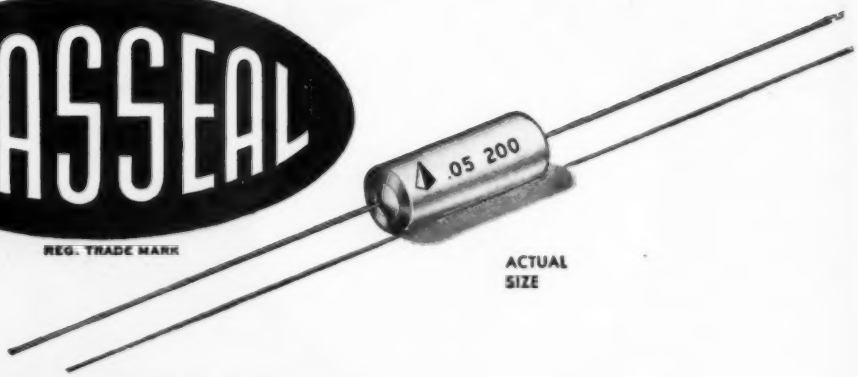
Write for engineering information or send 25¢ for handbook

Sarkes Tarzian, Inc. Rectifier Division, Dept. W, 415 N. College Ave., Bloomington, Indiana

Announcing

GLASSEAL

REG. TRADE MARK



ACTUAL SIZE

HERMETICALLY-SEALED *Miniature* TUBULAR PAPER CAPACITORS by PYRAMID

Pyramid Type PG "GLASSEAL" miniature paper capacitors are assembled in metal tubes with glass-metal terminals. They will fully meet the most exacting demands of high vacuum, high pressure, temperature cycling, immersion cycling and corrosion tests.

TEMPERATURE RANGES: −55° to +125°C.

CAPACITANCE RANGE: .001 mfd. to 1.0 mfd.

VOLTAGE RANGE: 100 to 600 v.d.c. operating

Available through your local distributor

PYRAMID Electric Company

GENERAL OFFICES and PLANT NO. 1
1445 HUDSON BLVD. • NORTH BERGEN, N. J.

PLANT NO. 2
155 OXFORD ST. • PATERSON, N. J.

A Modern SERVICE CENTER

By
MORT FARR

How one successful TV dealer is combatting the slump by going out after video servicing and sales.

By providing incentives for customers to pick up and deliver their own sets for servicing, Mort Farr has cut the cost of doing video servicing.

AT A time when service dealers throughout the country are pulling in their horns, many have questioned my judgment in choosing this particular time to expand my service operation rather than retrench.

To those doubting the wisdom of the move, let me say that I did it because it is good business! Too many dealers have been caught in the wave of pessimism that has been sweeping the industry and are either treading water or have struck out for shore. I have backed up my belief that you can swim against the current by building a new $75,000 service outlet!

In this building servicing can be done in an environment designed for the skilled professional technician, unhandicapped by cramped, makeshift quarters in a corner of the store. Here reconditioned merchandise can be shown on its own—not where it must compete with new stock. These sets don't have to be given secondary position on the floor or be suggested only when customers aren't willing to pay for new merchandise. It is sold for exactly what it is—used stock put in good working condition so that it will give years of economical service. This sort of merchandising has worked out so successfully that many local department stores have asked us to handle their trade-in sets. Unlike many dealers, we do not consider trade-ins a dead-end street.

The Service Shop

A professional environment, designed to fit the needs of technicians so that they can work with maximum comfort and efficiency, was the goal in setting up the service shop. The actual service area is 20 x 55 feet in size with windows, eight feet long and eight feet apart, along the length of the room. Work positions are laid out so that each technician is allowed his own eight-foot section of the bench with four feet of window and four feet of wall space.

The bench, like the floor, is of three-inch thick planking so that the heaviest sets can be mounted on it without danger. There is leg space beneath the portions of the bench which run under the window and a storage locker with sliding doors for each man under the other four feet of his work position. This part of the wall is mirrored so that the technician can determine picture linearity while working on the back of the chassis. Above the mirror is a shelf on which the technician can keep the manuals and service notes with which he is supplied.

To further encourage his use of this literature, a breadboard-type pull-out shelf is installed beneath the top of the bench on which he can rest his notes and manuals.

A *Jerrold* distribution system feeds the incoming television signal to a plug at each work position as well as to the display room where reconditioned sets can be shown in operation. One of the many original features of the service shop is the use of a three-position switch on the plug. This operates a pad which permits the simulation of conditions under which the set will be operated—a strong, medium, or weak incoming signal. In this way the set can be adjusted for the specific location in which it is to be used.

Other plugs at the far end of the room are also equipped with three-position pads so that as many as ten sets being

Over-all view of the service workshop. Carefully planned work areas give each technician elbow room and good lighting.

Linearity checks can be made easily by one technician by placing the receiver in front of a mirror and making the necessary adjustments from the rear of the television receiver.

given operational runs before going out to customers, life tests for new merchandise being considered by the store, or tests on intermittent sets brought in for repair can be handled at one time. This location can be viewed by all technicians in the room, permitting them to monitor the sets under their care without having to leave their benches.

Large, mirror-fronted cabinets, similar to those found in millinery stores, are set against the wall opposite the work bench. These are used for additional storage space and to permit viewing of tubes from the rear when consoles are being adjusted on the floor. There is also an island storage position for incoming and outgoing receivers and chassis when technicians are not working on them.

All new sets are unpacked, tested, and given a 4 to 8 hour run-in before being sent out to customers.

Stockroom

One section of the shop is devoted to a stockroom in which we can keep an extensive inventory of tubes, parts, and sub-assemblies to speed service. This room is kept locked at all times to facilitate inventory control. One member of the staff is responsible for the issuance of all materials and for re-ordering needed items.

Each technician is assigned his individual 18" x 18" locker to which he has a key. The lockers are open from the back and accessible from the stockroom. At the end of the day's work, he turns in any tubes still in warranty, his day's service reports, and a list of his requirements for the next day. This material is ready for him in his locker when he reports for work the following morning.

There is ample parking space in the immediate neighborhood for the technicians' cars. Space is also available on a paved parking lot for the loading of chassis and for the convenience of customers.

We are hoping to develop a large business in "cash and carry" TV repairs. We plan an intensive advertising campaign featuring the catch phrase "Bring Your TV Set to the Shop on the Way to Work and Pick It Up on the Way Home." In this way we hope to save manpower and give the customer much faster repairs than if we had to send a man out to pick up the set and then deliver it when it is repaired.

Salesroom

Before any merchandise is permitted to go to the salesrooms, it is given a thorough test and inspection for performance, finish, and value. Then it is tagged as approved

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One of the individual test positions in the service workshop showing the type of equipment each technician has available.

for sale and placed on display. Electrical outlets and antenna plugs are installed sufficiently close to each other to permit flexibility in the type of merchandise that can be shown and its arrangement in the room. Attractive floor layouts and displays are given as much consideration here as they are in a store which handles only new merchandise.

Our regular salesmen take turns manning the salesroom for a day. This assures top-level sales personnel at all times and serves to acquaint the staff with trade-in values and the reconditioned merchandise faster and better than would be possible by any other method. Since each salesman has an automobile parked at the main 69th Street store, he can drive customers interested in reconditioned items to the Service Center whenever he encounters these prospects.

In this way, the two stores operate as one, the need for having new and used stock competing for the same sale is eliminated, and an early step is taken toward giving the reconditioned merchandise the importance it must have in the very near future.

Finally it should be mentioned that each of our television technicians is trained to sell the service customer up to a new set through a trade-in deal. Approximately 75 percent of our trade-ins are prompted by these technicians. Their role in building this lucrative business is fully recognized and these fellows have done a nice job.

TV Follows Automobile Pattern

The approach to my business was based on the idea that the operation of the television dealer will ultimately pattern itself after the automobile business. In my opinion it will be just as strange, a couple of years from now, for a TV dealer to sell a set to a customer and turn him over to a "service contractor" as it would be for a purchaser of a high-priced automobile to be told that if he has any service difficulties to take the car to some garage.

People buy a TV set for the entertainment it affords and not for what it is. It has no value unless it is performing satisfactorily. Here, again, this differs from radio as many radio sets have operated poorly for years but the customer didn't know the difference. However, you cannot fool the eye and the purchaser demands much more in the way of performance from a television set.

A successful TV dealer will be required to stock an adequate supply of repair parts and to have on hand at all times the facilities and trained personnel necessary to make the required adjustments on faulty receivers. I believe that one of the foremost requirements of a reputable manufacturer will be that the dealer who handles that manufacturer's products be just as interested in servicing the set intelligently as he is in selling it. I know of no factor which influences more purchasers than the personal recommendation of a friend, neighbor, or relative who is pleased with the performance of a particular set and the service rendered on it. Dissatisfaction is broadcast faster and more widely than satisfaction, so guard your reputation jealously and make every attempt to keep your customers happy.

Another point to remember in drawing the comparison between the TV business and the automobile industry is the trade-in problem. Some years ago, the automobile dealers of America woke up and found their capital all on the used car lot. They recognized the need for merchandising these cars at a profit and for providing transportation for that segment of the population that couldn't afford new cars. From now on a TV dealer's ability to merchandise sets in volume will depend on his ability to dispose of the trade-in sets at a profit. This will require servicing facilities for reconditioning so that they can be sold with a guarantee. He must also have a showroom for the display and sale of these reconditioned sets.

The future of television servicing indicates that the art will get more complex as we advance. The day of the screwdriver mechanic is past and we are staking our future on a profession that promises to be a really big business in the not-too-distant future. If television lives up to its predictions, I want to be part of that billion dollar industry! There will be plenty of dealers to lap up the gravy—but the best way to insure your share of the business is to go into it, stick with it, and boost it! —30—

Reconditioned sets are sold in a specially-located sales area and not in competition with new merchandise. William Alberti (left) and Mort Farr look over one of these reconditioned jobs.

Over-all view of the new $75,000 Farr service building which houses the service facilities and a showroom for used TV sets.

Round-the-World VOICE RADIO SYSTEM

By
CAPT. W. WALDO LYNCH
Communications Superintendent
Pan-American World Airways System

Pan-American's globe-circling airways system is protected by an elaborate radio communications net.

A PAA ground station at New Delhi, India, one link in world-wide radio chain.

COMMUNICATIONS passed another milestone recently with the inauguration of a Round-the-World Voice Radio System. *Pan-American World Airways'* thirty-two high-frequency radio ground stations, located on sixteen continents and islands, weld the airline's 19,687-mile voice radio chain around the earth. This development has eliminated the necessity for sending and receiving messages in Morse Code; air-ground communication is now handled by *Pan-American* airline pilots.

Most of the stations are operated by the civil aviation authorities of the various local governments with the exception of those stations, shown on the map on the facing page, in the U. S. and its territories operated by Aeronautical Radio; in Bangkok operated by ARINC of Siam; and the stations in Germany and the one at Manila which are operated by *PAA*. When we began developing radiotelephone for air-ground service over long international routes, we found that in order to install a chain of stations covering a wide geographic area we had to promote what is known as "network operation." All these stations had to have common frequencies. On the long routes each station had to be equipped with frequencies of the order of 3-5-8-11 and quite often 17 or 18 mc. All the ground stations had to guard all of the frequencies assigned to their network, simultaneously and continuously.

We arrived at the requirements for the various orders of frequencies after studying the particular areas to be covered. By this I mean, we first considered a geographic area such as the Atlantic and decided that we would try to cover the whole Atlantic area as one network. We then took a look at the distance between the various stations of the network and we imagined aircraft flying at any point in the area. We then studied the propagation tables to see what frequencies would be required in order to allow any aircraft in the area to contact one of the ground stations at any time of the day or night. A better understanding of what we were trying to do might be gained by this example. Consider this region as a square bounded by four stations. The sides of the square are 1000 miles. We could place an aircraft at any point in this area and an inspection of the propagation tables might indicate that we would need frequencies on the order of 3 and 8 mc. to provide 24 hour service without skipping over. It would also be apparent that the 8 mc. frequency would be high enough to travel the maximum distance required.

The selection of the actual frequencies depends, to a great extent, on international agreements, location with respect to the geographic area involved, and the attitudes of the various nations which must approve the frequencies.

At this point, since we have partially described a network, it might be well to continue with its description. Let's take another look at this network built around the 1000 mile square with stations at the four corners. First, each of these stations is equipped to transmit and receive on each of the frequencies which have been selected for operation. Each station has operators who listen to each of these frequencies at all times.

As some of our networks become more complicated and extend over longer distances, conditions prevail when an airplane cannot always contact the primary or control station on one of the frequencies assigned to the network. In this case, the ground operators are trained to listen to all communications and they seem to sense immediately how the frequencies are propagating. Immediately they understand that possibly an aircraft signal is skipping the control station because they hear the control station making other contacts but not with the aircraft in question. They also hear the aircraft call the other station, but they do not hear the control station answering the aircraft. The operators are trained to recognize situations such as these, and an operator at a secondary station then calls the aircraft and offers assistance. The pilot, hearing this return call, gives his communication to the ground station which then relays it to the control station.

This brings up another point. The control station in a network changes from time to time and there may be several control stations operating at the same time. The control station, for an individual aircraft, is the sta-

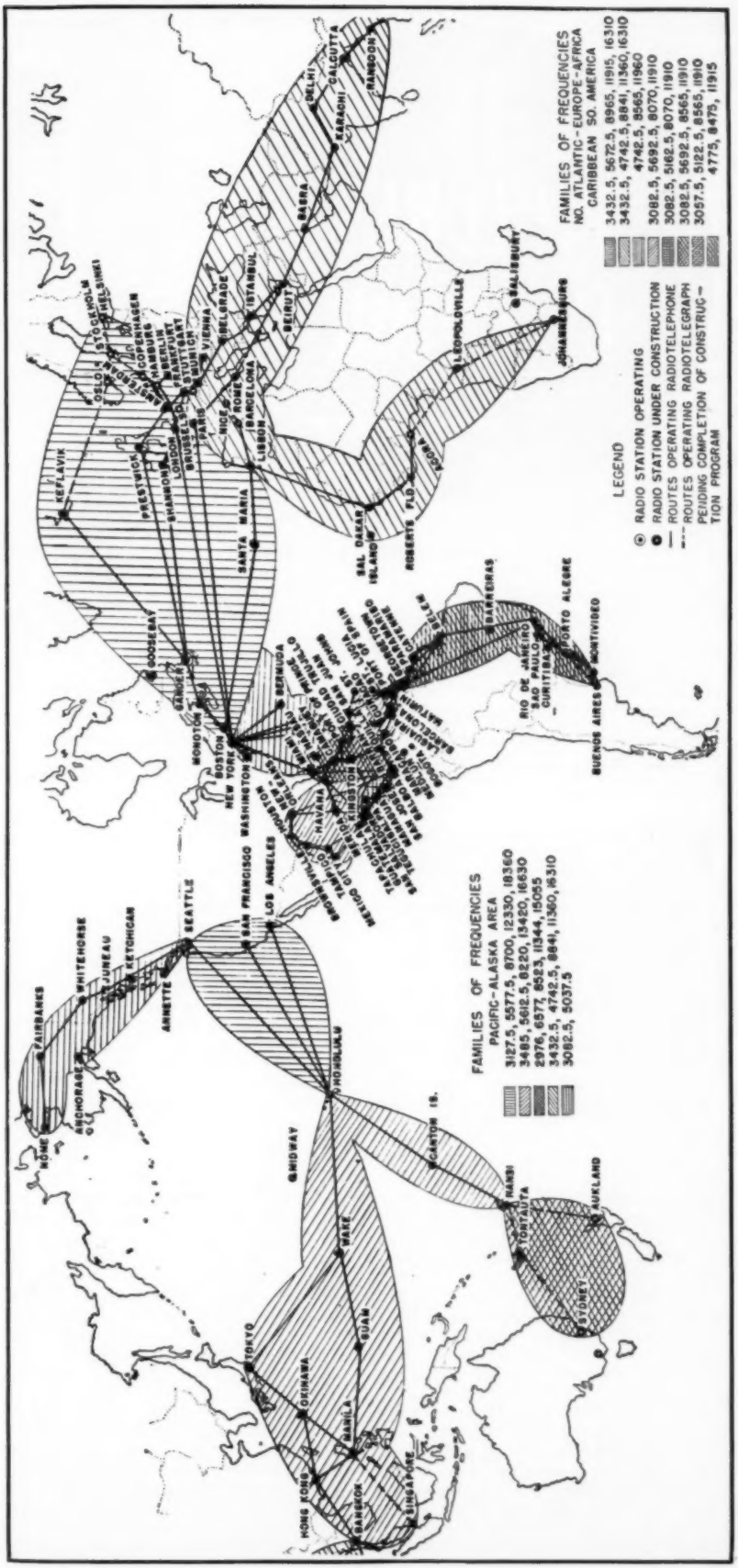
Pan-American's world-wide radio system map showing principal ground stations. →

tion located in the airways traffic control region within which the aircraft is flying at the time. The reason for this is that the pilot will receive all his instructions and clearances from that air traffic control center, and he will naturally attempt to have direct communications with that radio station. Failing to do this on any one of the frequencies at his command, he will then set up contact with any other station able to contact the control station directly, and failing that, he will attempt to make contact in two relays. The pilot is not particularly burdened with this problem since the ground operators immediately step in and assist in setting up the most direct flow of communications.

In the early days of our operations we found that it was absolutely necessary to have crystal-controlled transmitters and receivers at all the ground stations and aboard the aircraft. We also found that all of the aircraft equipment had to be push-button operated.

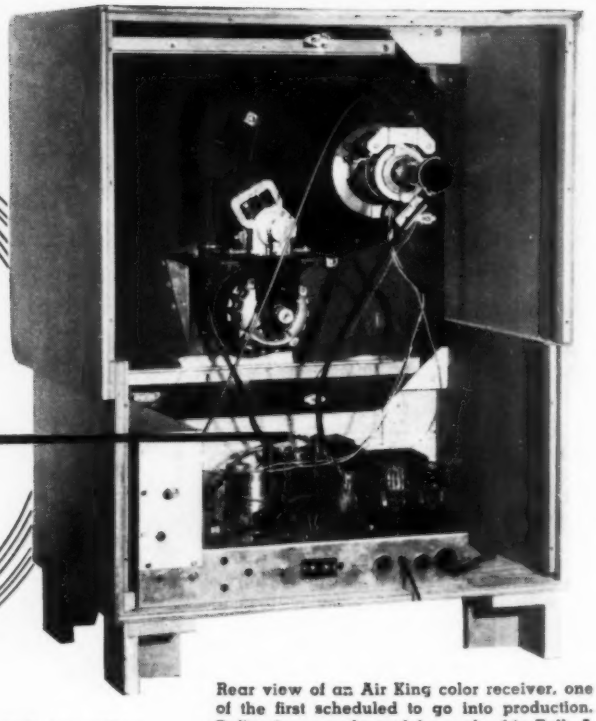
All the ground transmitters used in the world-wide system are multi-channel units. A typical example is the *Collins* 23 ID transmitter. This is a 3 kilowatt unit which has automatic tuning on ten preselected channels. The frequency range is from 2 to 20 mc. Each channel is crystal-controlled and the transmitter is shifted by remote control through a dialing system. *Collins* also makes a 400 watt transmitter which works on the same principle. We also use a number of *Wilcox* 96-C transmitters. These are 2½ kilowatt units with a power supply, a modulator, and separate radio frequency bays. Each r.f. bay is equipped with coils which fit into various bands. Any number of bays up to ten can be added with each bay set on a desired frequency. This transmitter is also shifted through a remote control dialing system. We have a number of *Federal* type FTR-3 transmitters. These are 3 kilowatt jobs of the same basic type as the *Wilcox* 96-C. In South America we have a number of 400 watt *Western Electric* 4WTF transmitters. These are two-channel, three-frequency transmitters which have a single power supply and modulator, two r.f. sections, one of which has a double crystal holder and a small switch so that two frequencies within 3% can be tuned up in the same channel. The 4WTF is housed in a single rack about two feet square. The more powerful transmitters are built up in separate units. Also in South America we have a number of transmitters which comprise units designed and built by a former *Pan-American* subsidiary company. The driver is a 12 ACX-2. This includes a power supply and two r.f. channels built in the same rack. The 12-ACX2 feeds an RFA-50 which is a 4 kilowatt r.f. amplifier. The RFA-50 is modulated with a GM 40 which is

(*Continued on page* 106)



TV PICTURES IN COLOR

By
NORMAN CHALFIN



Rear view of an Air King color receiver, one of the first scheduled to go into production. Deliveries are planned for early this Fall. A selector switch on the front panel permits reception of all present channels in monochrome or color. Set employs a rotating disc placed between the front of cabinet and the face of picture tube. When using a rotating disc, the largest useful screen size is 12½". It is not impossible to make a set, which is basically the same as the one shown, using the revolving drum. The color drum revolves across the longitudinal axis of the picture tube. With this arrangement larger screen sizes are possible. The tri-color tube could also be used, however at present time there are certain production difficulties to be overcome which may take as long as several years to resolve before sets using tri-color tube are produced in reasonable quantity.

Starting in the East, CBS colorcasting will spread to other major television areas in the near future. With a few changes in sweep circuits and a color disc, you can experiment with your small screen receiver and obtain a full color pattern.

THE rainbow has been brought to your TV screen. The recent Supreme Court ruling approving commercial telecasting of color video programs in the field sequential system developed by *CBS* opens up a new field for the TV technician in which to apply his talents and earn new income. It just may be that this rainbow does have a pot of gold at the end of it.

Conversion of your present TV black and white receiver is by no means a complicated operation. With the seven inch sets that many folks have now relegated to the basement playroom, the den, or the kids room, it is but a matter of a couple of hours' effort and less than five dollars' expenditure to adapt it for the different sweep frequencies used in the field sequential color system. This will provide reception of the color broadcasts in black and white. Color reproduction will require a color converter.

For sets with larger screens, or for projection receivers, color adaptation and conversion will be more costly and require somewhat more effort, but can be accomplished successfully and much to the delight of all who watch.

Most technicians are familiar with the sweep frequency standards for black and white TV. They provide 30 interlaced field frames per second and in each frame there are 525 horizontal lines. The horizontal sweep frequency is thus 30 x 525, or 15,750 cycles per second. Since each frame contains two fields, the vertical sweep frequency is 60 cycles per second.

The color television system thus far approved has a line structure of 405 per frame. Each frame contains the three primary colors used to produce the color picture and occurs in $\frac{1}{24}$th of a second. The color fields are also interlaced as in black and white. The color fields are scanned in the order red, blue, green. The first sweep in red scans lines 1, 3, 5, . . . the odd lines, while the blue scan which follows covers lines 2, 4, 6, etc., the even lines. The third scan with the green filter in place again takes in the odd lines. The fourth time around is red, scanning the even lines. Now we have one full frame in red. The fifth scan fills in blue odd lines and the sixth the green even lines. Each field then covers only 202½ lines and when the six fields are scanned all three colors have been covered in interlaced sequence. Hence, the name field sequential color system. Each field lasts $\frac{1}{144}$th of a second. A complete sequence of colors is scanned in $\frac{1}{48}$th of a second. There are six color fields scanned in $\frac{1}{24}$th of a second to make up a complete color frame.

From the foregoing description it can be seen that the field frequency must now be 144 cycles. This is the vertical sweep frequency. The horizontal sweep frequency will be 405 lines x 24 frames x 3 colors. This equals 29,160 cycles.

The adapter for color TV permits the sweep oscillators to operate at 144 cycles for vertical, and 29,160 for horizontal. Since in both cases this is a higher frequency than for the black and white TV sweep generators, the frequency is changed by a decrease in the value of horizontal and vertical hold control values.

In Fig. 2 there is illustrated several well known circuits of the sweep oscillator sections of commercial seven inch TV receivers. These are the simplest units to adapt for reception of the 405 line, six field per frame color transmissions. In every case there is a limiting resistance in the grid of the oscillator section of the sweep generator, before the hold control. The hold control in all the seven inch TV receivers was on the front panels. It is therefore desirable that this should not be changed. The only change is made in the limiting resistance. Reducing the value of the limiting resistance to about 10,000 or 20,000 ohms will be sufficient to produce a value that will make frequency hold adjustment possible with the original hold control for

both color and black and white. A four-pole or six-pole, double-throw switch (depending on the set being adapted) should be used for switchover from black and white to color.

The reduction in sweep oscillator grid resistance in either a cathode coupled multivibrator, or in a blocking oscillator, generally results in a lowered output amplitude of the oscillator. The picture, because of this, will be a smaller size than in the black and white position. For the more athletic users of the set it will be no great chore to go behind the set each time it is switched for color and readjust the size controls. It is not too expensive and much more convenient to install an extra pair of size controls for horizontal and vertical which are once adjusted for the color size requirement and then need not be touched again. The size control for color should match the one for black and white to which it corresponds. In some circuits the size control is in the plate load circuit (*Teletone*, 149; *Belmont*, horizontal; *Motorola* 71, horizontal only, etc.) or in the grid of the vertical deflection amplifier, as in *Hallicrafters*, etc., or as a "B" supply bleeder as in the *Hallicrafters* T54.

For the *Teletone*, the *Motorola*, and any others in which the size controls are part of the plate load, only a four-pole, double-throw switch is required.

Where the size control is part of the amplifier input grid circuit or part of a "B" supply bleeder, a six-pole, double-throw switch will be needed.

To adapt a circuit such as the *RCA* 630TS, the changes illustrated in Fig. 1 are required. Six points must be switched here also. This is the basic arrangement. The many commercial variations of the 630 follow the same circuit arrangement up to the output of the 6BG6G tube. As a result, supplying details of what to do with this part of the circuit becomes difficult to accomplish without confusion.

It is quite obvious from the circuit why the capacity value was changed in the horizontal discriminator circuit. If it were not done the control circuit would not follow. (This is C_{188} in the original). C_{189}, the reactance coupling condenser, is changed for the same reason. The horizontal drive is also changed so as to provide a more suitable pulse shape for the higher frequency. In the vertical circuit the changes are much the same as for the 7" set circuits described previously.

No difficulty should be encountered with the vertical portion of the circuit.

The fact that there is a higher frequency and the different pulse shape in the horizontal circuit, the retrace portion of the pulse with its higher velocity is likely to produce nearly twice as much voltage in the high voltage system. In some of the designs submitted by the *CBS* people, new transformers were shown to get around the problem presented in this way. In many sets there have been no change at all and satisfactory results have been obtained.

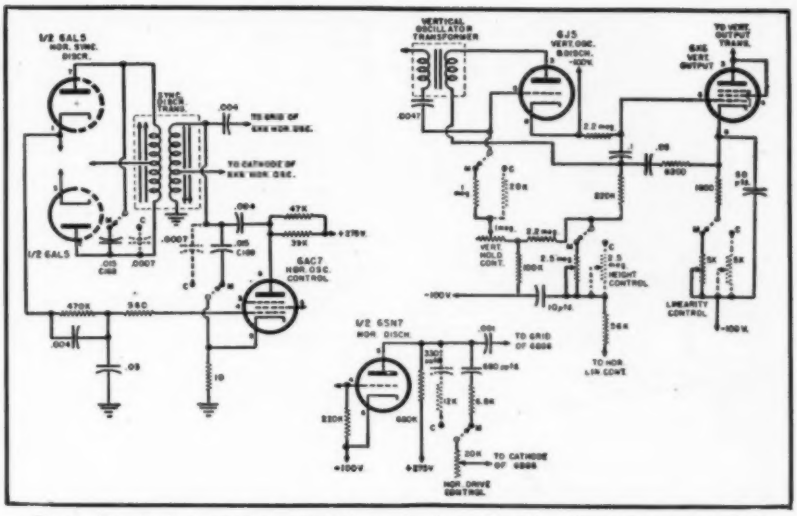
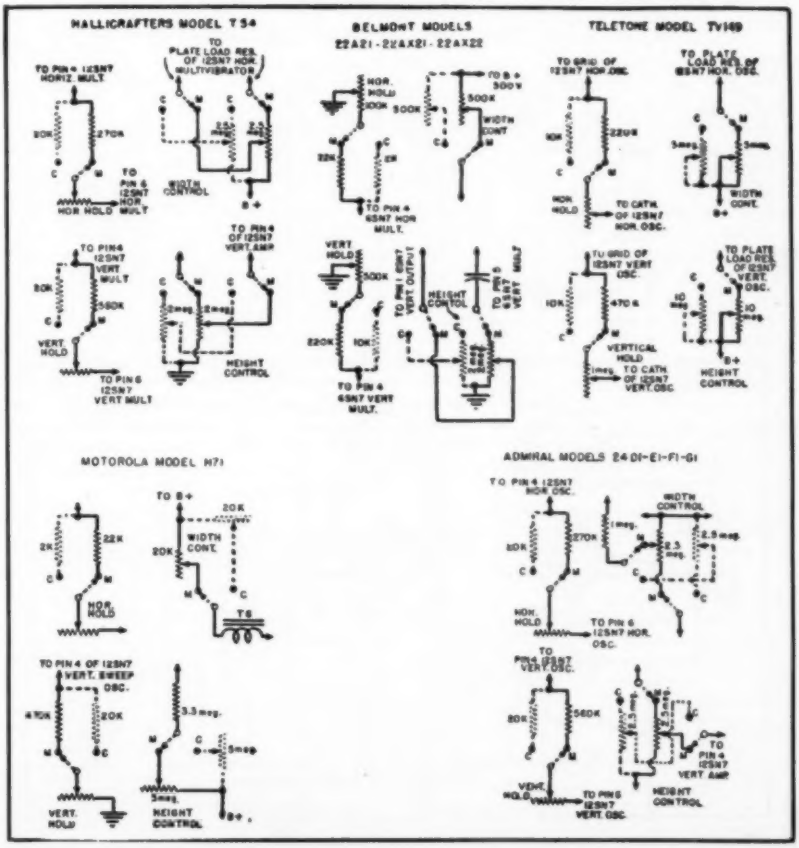


Fig. 1. Circuit changes (shown dotted) required to adapt the RCA 630TS and 8TS 30 to color. Other commercial versions of the 630 chassis must be handled differently.

One technique that is probably the kind of approach practical manufacturers are taking is to build a separate adapter unit as is illustrated in Fig. 4. This is the circuit furnished by *CBS* as an adapter for the *RCA* 9T246 which employs a "synchroguide" type of horizontal a.f.c. With it plugs are placed

Fig. 2. Circuit diagram of the sweep oscillator section of several commercial 7" receivers. The changes, as shown in dotted lines, affect only the vertical and horizontal sync and size adjustments. These conversions are extremely simple and a few resistors, potentiometers, and switches are the only components required. Although these particular conversions are simple it should not be assumed that all receivers can be as easily adapted to CBS color. Many receivers are difficult to convert and will require much more elaborate changes than those indicated here.



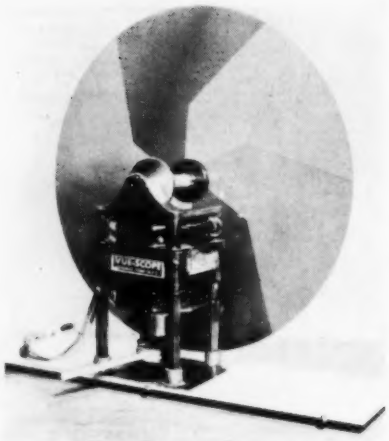


Fig. 3. A commercially built color conversion disc assembly manufactured by Celomat Corporation of New York. The assembly includes a 12-inch disc, built out of Fibestos cellulose acetate plastic sheeting, and a manually operated synchronization unit. A unit similar to this but with an automatic synchronizing control is available in kit form from the above company. A 12-inch plastic disc provides a picture of about 6 inches. Picture magnifier incorporated provides larger image.

under the vertical sweep circuit and amplifier tubes with the switching accomplished outside the receiver in the adapter unit. The horizontal circuits are completely new in the adapter and the 6BG6G is inserted through a plug in the adapter. All switching in the horizontal system is in the adapter with circuits providing horizontal deflection voltages and high voltage d.c. for both the monochrome and color positions entirely produced within the adapter. The details of the special high voltage output transformer in the horizontal deflection circuits are given in the table shown with Fig. 4. Full electrical details are shown in the circuit. The layout and wiring of the chassis is a matter of individual choice. The only specific precautions which must be observed are shown in the diagram at the three points where low capacity wiring is indicated, and at the shielding of the vertical oscillator cable.

In receivers obtaining their high voltage for the CRT from other than flyback deflection sources, such as r.f. power supplies or (as in the *Norelco* "Protelgram" or *Duo Vue* projection systems) from a 1000 cycle pulse supply, the changes required may be made as in the design for the 630 or for the 9T246 as shown in Fig. 5. In these instances there is no concern with the particular problem which results from the flyback high voltage supplies.

It is important to be reminded that all of the circuit information provided in this article is designed only to provide adaptation of monochrome TV sets so that they may receive, in monochrome, the color programs which will be broadcast.

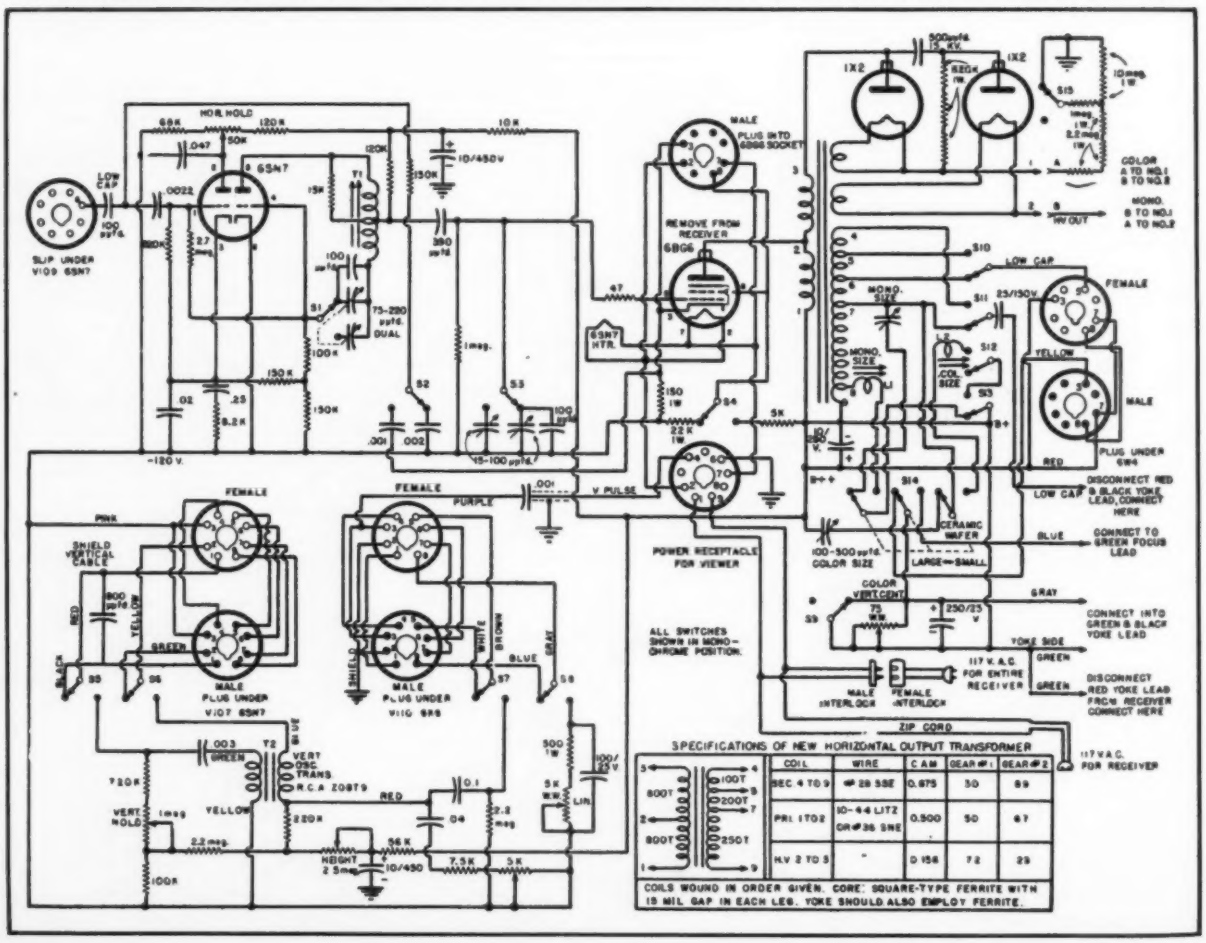
To receive the picture in color a second device is required. This is called the color converter and in its most elementary form consists of a segmented wheel with six color sectors, *i.e.*, red, blue, green, red, blue, and green.

This disc is large in comparison with the tube size, running from two to three inches larger than twice the raster size. The color segments used in the disc must be made up from specific shades of red, blue, and green in order to provide maximum color fidelity. Materials which have proven satisfactory include the *Eastman Kodak* filters designated the Wratten 26 (red), Wratten 47 (blue), and Wratten 58 (green).

In order to keep the colors from running together (false color mixtures) the filter must move parallel

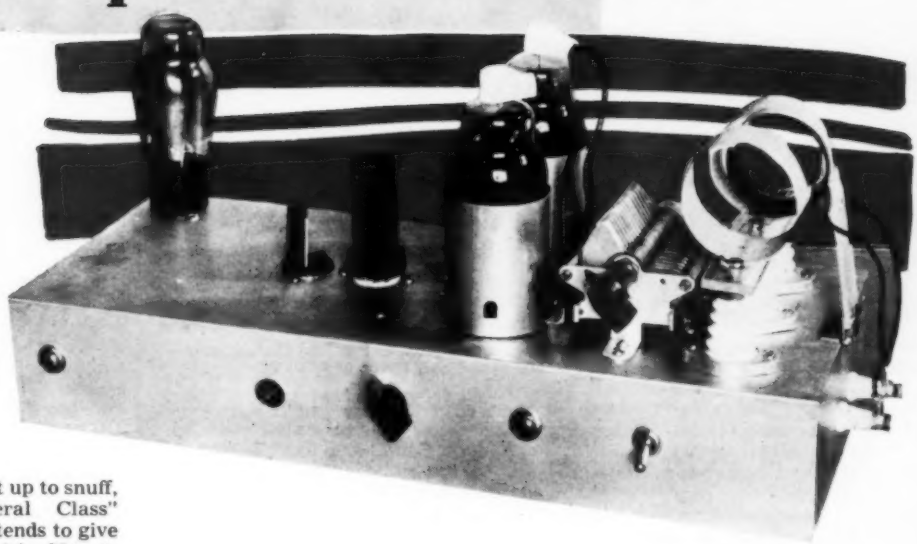
(*Continued on page* 80)

Fig. 4. Adapter unit designed to be used with the RCA 9T246 receiver. This well-engineered unit is suitable for commercial conversion work.



160 METER RIG Using Clamp Tube Modulator

By
STAN JOHNSON
W0LBV



Over-all view of 160 meter rig built by the author. The controls are (l. to r.): mike jack, pilot light (PL_1), tuning condenser (C_2, C_3), metering jack (J_1), the switch (S_1).

The clamp tube modulator described herein can be added to any rig using a pair of 807's or 1625's.

WITH 10 meters not up to snuff, many a "General Class" (Class B) ham intends to give the lower frequencies a whirl. If he is a confirmed phone man this means 160 meters—the only low frequency phone band open for the General Class ticket.

Getting a 10 meter rig to operate on 160 meters is quite a trick—so much of one, in fact, that in most cases it is easier to start all over again and build a rig for 160. Fortunately, a 160 meter r.f. section can be quite simple. If a modulator is already available, the investment in parts is not very great.

The rig described in this article was built up primarily for use with a standard class B modulator. However, a clamp tube modulator was built-in, so that the transmitter is entirely self-contained. This feature may pay off some day if the rig is needed for emergency or Civilian Defense work. Further, the clamp tube modulated rig is an ideal unit for the ham with a lean pocketbook. At a later date, a standard 60 watt audio unit can be added for plate modulation.

The clamp tube modulator section is indicated in the schematic, Fig. 2 (everything within the dotted lines), as a unit, and it can be added to any rig using a pair of 807's or 1625's, whether in push-pull or parallel. Such a rig will really go places on 10 meters when the band is open, as you know, if like the writer, you have heard VE1YO up in Nova Scotia pound in 10 db over S-9. VE1YO uses a pair of 807's screen modulated.

The design of the transmitter is straightforward—but it often helps in building to know the "why" of some of the circuit. First, a 6AG7 was chosen as the oscillator tube, because it is the best shielded of the tubes of its type available. Further, it lends itself ideally to the "modified Pierce" circuit which in theory, at least, provides the equivalent of a "buffer" stage—with only one tube.

The 6AG7 drives a pair of surplus 1625's (identical with 807's except for 12.6 volt heaters and different socket connections.) The 807's are shown in the diagram. These are used in push-pull. Push-pull was chosen instead of the more common parallel arrangement because push-pull amplifiers are not as subject to parasitics and other troubles as are parallel hook-ups.

The built-in clamp tube modulator is a triode-connected 6L6G. The 1625's require very little audio for screen modulation, the 6L6G being adequate when driven with a single-button microphone.

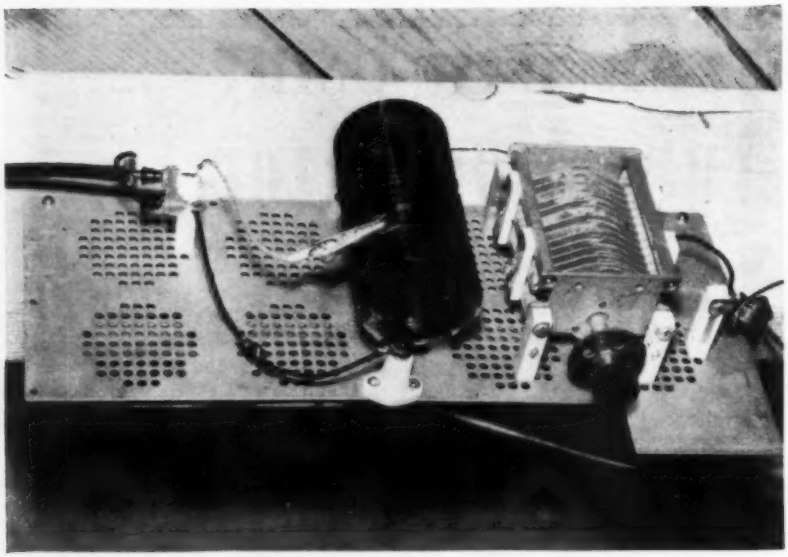
It will be noticed in the circuit that there are, in effect, two screen grid dropping resistors, R_6 and R_5. R_6 is the standard dropping resistor, which cuts the voltage from the high voltage supply down to a value (approximately 250 volts) suitable for normal operation of the amplifier. When switch S_1 is opened, resistor R_5 is cut into the circuit, further lowering the screen voltage, dropping it down to a value which makes screen modulation possible with the clamp tube. To use the rig with a standard class B modulator, switch S_1 is closed, the 6L6G pulled from the socket, and the modulated plate voltage applied to the high voltage terminal.

The transmitter is built up on a standard 3 x 7 x 17 inch chassis. The crystal oscillator circuit (except for the tube) is mounted *below* the chassis, including the coil. This makes it possible to shield the input from the output circuit of the transmitter, and eliminates any necessity for neutralizing.

The tuning condenser C_2, C_3, across the oscillator coil (L_1) is a standard broadcast band type dual variable condenser of approximately 350 $\mu\mu$fd. per section (try to find an old one, with as much spacing as possible between plates.) The coil L_1 is of such a size that the condenser will tune *both* 160 meters and 80 meters without changing coils. This greatly simplifies band-changing—going to 80 requires only a different plate coil in the output circuit of the final amplifier.

The small trimmer condenser C_5 is intended to insure proper balance of the grid drive to the amplifier. Its adjustment seems to be anything but critical—in fact, omitting it will probably cause no harm. If you do include it, set it at approximately half capacity.

Parasitic suppressors, RFC_3 and RFC_4, are connected to the grids of the tubes (right at the tube sockets) and are made up simply by winding 18 turns of No. 22 d.c.c. wire on a ¼"



Antenna tuner used by the author. Wiring diagram is shown in Fig. 1A. The antenna consists simply of a straight wire 130 to 160 feet long. The length is not critical.

diameter resistor which can be of any high value (for example, 50,000 ohms). The resistor serves simply as a coil form—a piece of polystyrene rod can be used instead.

Standard manufactured 160 meter coils can be used for the final amplifier if desired. However, many jobbing firms do not stock coils for this band. Furthermore, you can save several dollars by winding your own.

As illustrated, the coil, L_2, for the amplifier is mounted on a polystyrene strip fitted with three banana plugs. The coil is made up of No. 22 d.c.c. wire and is self-supporting.

To make the coil, first of all prepare a winding form. The best thing for the purpose is a heavy cardboard mailing tube, which should be approximately 2¼" in diameter. This tube should be wrapped with a few layers of waxed paper. Then the coil is wound in the usual way and given a *heavy* coat of coil dope or china cement. After the coil is *thoroughly* dry, remove the mailing tube form carefully by pulling it apart with long nose pliers. The coil which remains is surprisingly strong.

The antenna pick-up coil, L_3, is wound in the conventional way on a piece of bakelite tubing of approximately the same diameter as the plate coil. The antenna coil, L_3, is mounted on a piece of polystyrene, which, in turn, is fastened to a small hinge affixed to the chassis. This hinge is made "stiff" by hammering on the rolled-over metal portion which carries the hinge pin. Flexible leads connect the antenna pick-up coil with a pair of insulators which serve as a connection for the antenna.

The microphone battery B_1, (a single flashlight cell) is carried under the chassis, supported by a metal bracket. No microphone switch is included—which is OK if you remember to unplug the microphone when you go off the air. If the mike is left plugged in, the battery will run down.

To eliminate the meter in the oscillator circuit, a standard dial light is connected to a piece of hookup wire to form a long loop L_4, and this is stuffed inside the oscillator coil form. Varying the length of lead inside the coil form will vary the coupling. Sufficient radio frequency energy will be picked up to light the bulb when the oscillator is oscillating. The bulb is mounted in front of the chassis in a rubber grommet.

As with any rig, it is a good idea to test out the oscillator section first with the amplifier tubes plugged in and the 45 volt "C" battery connected, but the high voltage *not* connected.

Rotating the oscillator tuning condenser should make the dial light, PL_1, light up. If this checks out OK, connect a milliammeter in series with the grid bias battery and measure the grid current. It should be 8 ma., or somewhat *less*. If higher, raise the value of either R_1 or R_2, so as to lower plate voltage on the oscillator. *This is an important matter—higher grid current will cause erratic operation of the amplifier and make modulation difficult.*

With the grid current in line (should it be lower than 6 ma. reduce the value of R_1 or R_2) you are ready to try the rig out under load. Initially this can be done by connecting a 75 watt light bulb to the antenna pick-up coil. A milliammeter can be plugged into the jack (J_1) to allow reading plate current (as well as grid and screen).

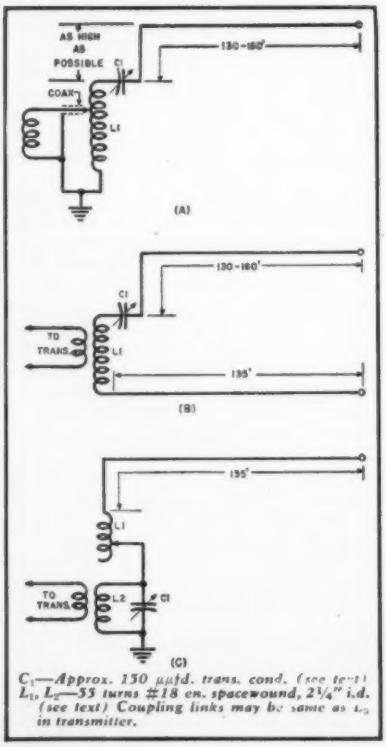
If the 75 watt bulb lights up fairly well and the resonance dip as indicated on the milliammeter is sharp and clean, the rig is probably performing OK and you are ready to hook it to an antenna.

Getting up a suitable antenna for 160 meters is quite a trick inasmuch as the ideal antenna would be a vertically polarized half-wave radiator. This would mean 266 feet straight up—and yes, there is a ham (W5AOE) who has such an antenna, which once belonged to a commercial broadcasting station. Of course, such an antenna is out of the question for most hams—and there are a couple of antenna designs which are practical for the average backyard.

The simplest of these is shown in Fig. 1A. It consists simply of a wire 130 to 160 feet long (length not critical) "worked against ground." The straight up and down portion should be *as long as possible* since it does most of the radiating.

This antenna has an Achilles heel in that the ground connection must be good, and good grounds are hard to come by. The usual cold-water-pipe ground is seldom good enough. At the writer's station, a fairly good ground was achieved by driving a pipe into a window well alongside the north side of the house, dumping a couple of bags of salt into the well, and then periodically soaking the whole thing down by running the garden hose on it. The result is a ground which has reasonably low resistance. Even so, unless you are lucky enough to live alongside of the ocean or Great Salt Lake the antenna counterpoise arrangement shown in Fig. 1B is a better idea. The counterpoise (strictly speaking it is not that but it performs the same function) can be a wire strung close to the ground at any convenient height and in most any shape. For example, it

Fig. 1. Antenna tuners for 160 meters. (A) Simple Marconi as was used by author and illustrated in photograph above. (B) and (C) Alternate methods that could be used. (B) Counterpoise and (C) voltage fed.



C_1—Approx. 150 μμfd. trans. cond. (see text) L_1, L_2—55 turns #18 en. spacewound, 2¼" i.d. (see text) Coupling links may be same as L_3 in transmitter.

can be run close to the ground along a hedge—or at clothesline height across the backyard.

If you haven't room for a counterpoise, another "out" is shown in Fig. 1C. Here L_2 and C_1 tune to the 160 meter band as a parallel-tuned resonant circuit. L_1 adds sufficient length to the antenna so that it tunes up just as if it were a 266 foot wire, in other words, is fed as a voltage fed *Hertz*. This procedure eliminates the importance of a ground connection capable of handling high current without loss. The tap on L_1 is determined by experiment, being the value which gives the best loading.

One of the photographs shows a simple antenna tuner which is suitable for use with the Marconi antenna, and with some modification, with the others. The metal base and the tuning condenser are from a tuning unit of a BC-375 transmitter. The coil is "home-brewed," following the same general procedure used in building the plate coil for the transmitter. In this case, No. 18 enameled wire is used, and spaced out by winding No. 22 wire (or heavy cord) between the turns as the turns are put on. Then the No. 22 wire is removed, and the coil doped with ribbons of *Duco* china cement, approximately 1 inch apart around the circumference of the coil. Use *plenty* of cement, and after it has dried for a couple of days, put on a second layer. Allow two or three more days for drying, then peel out the cardboard form, as described previously.

The position of the tap on L_1, Fig. 1A must be determined by experiment (start with the 10th turn). The idea is to use the tap which gives the best loading. Coil L_1 is purposely made plenty big, so that it will load up almost any wire.

In tuning up, rotate C_1 for peak r.f. as indicated by a standard flashlight bulb on a pick-up loop. Go easy, as tuning will be sharp.

If the rig is used with a standard modulator, it is loaded up like any other rig. If the clamp tube modulator is used, one important thing is to use *plenty* of antenna coupling, *more than would be used normally*. Unless *heavy* antenna loading is used, the rig may modulate down, as indicated by the bulb and pick-up loop. Increasing the antenna coupling should cure this, if not, the only solution is to increase the value of R_5 and thus lower screen voltage.

For clamp tube modulation, the screen voltage as measured at the screen should be approximately 135 volts (switch S_1 open). Plate-to-cathode voltage on the 6L6G clamp tube (this voltage controlled by adjusting R_7) should be about 250 volts.

Frequencies available for 160 meter operation are as follows:

Mississippi River to East Coast U. S., except Florida and Gulf states: 1800 to 1825 kc., and 1875 to 1900 kc. Final input shall not exceed 500 watts day, 200 watts night.

Mississippi River to West Coast U. S., except Gulf states: 1900 to 1925 kc., and 1975 to 2000 kc. Input 500 watts day, 200 watts night, except in the state of Washington where daytime power is limited to 200 watts and nighttime power to 50 watts.

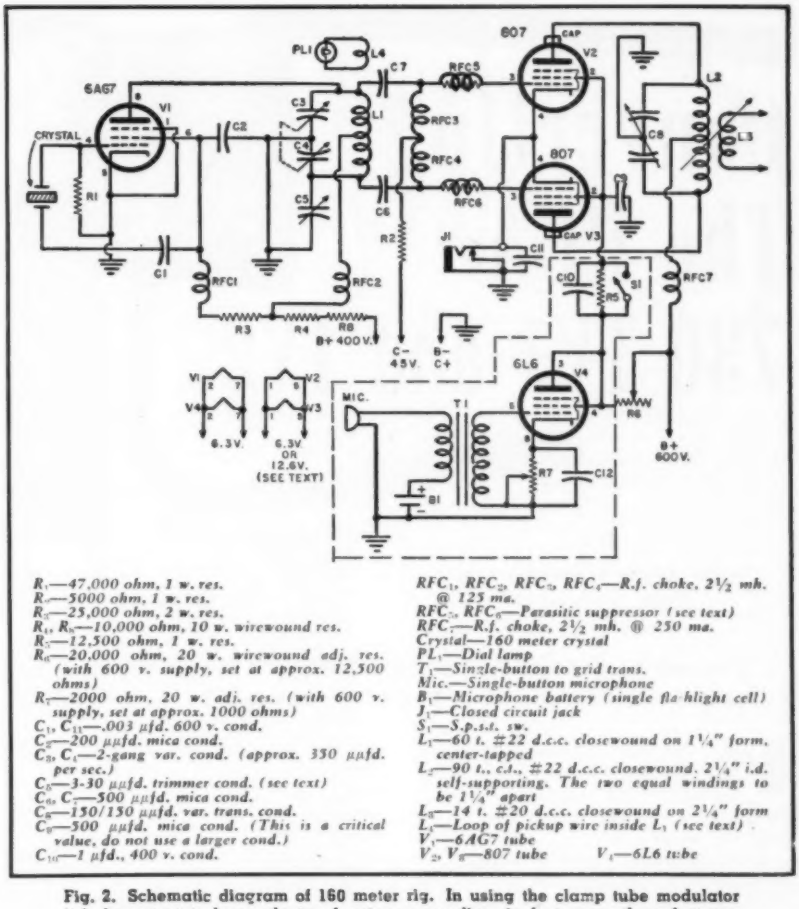
Florida and Gulf states: 1800 to 1825 kc., and 1875 to 1900 kc. Input 200 watts day, no operation at night.

Puerto Rico and Virgin Islands: 1900 to 1925 kc. and 1975 to 2000 kc. Input 500 watts day, 50 watts night.

Hawaiian Islands: 1900 to 1925 kc., and 1975 to 2000 kc. Input 500 watts day, 200 watts night.

Don't expect miracles with a clamp tube modulated rig in heavy QRM. You'll have to substitute good operating for power and find times to operate when the competition isn't too stiff. The next best bet is to get into a "round table" and let a couple of high power buddies keep the channel open!

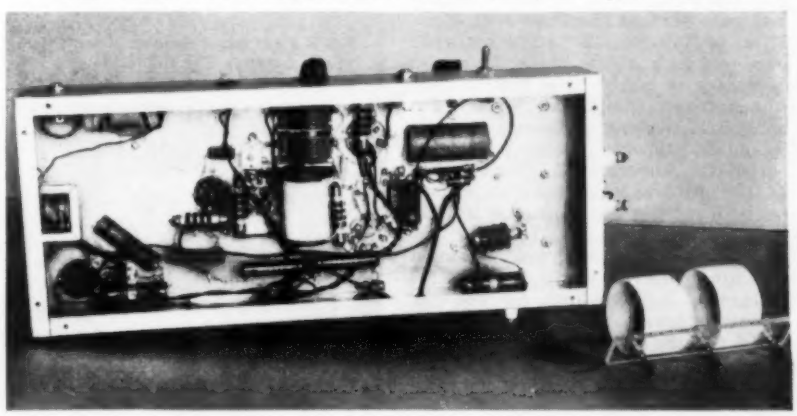
—30—



R_1—47,000 ohm, 1 w. res.
R_2—5000 ohm, 1 w. res.
R_3—25,000 ohm, 2 w. res.
R_4, R_5—10,000 ohm, 10 w. wirewound res.
R_6—12,500 ohm, 1 w. res.
R_7—20,000 ohm, 20 w. wirewound adj. res. (with 600 v. supply, set at approx. 12,500 ohms)
R_8—2000 ohm, 20 w. adj. res. (with 600 v. supply, set at approx. 1000 ohms)
C_1, C_{11}—.003 μfd. 600 v. cond.
C_2—200 μμfd. mica cond.
C_3, C_4—2-gang var. cond. (approx. 350 μμfd. per sec.)
C_5—3-30 μμfd. trimmer cond. (see text)
C_6, C_7—500 μμfd. mica cond.
C_8—150/150 μμfd. var. trans. cond.
C_9—500 μμfd. mica cond. (This is a critical value, do not use a larger cond.)
C_{10}—1 μfd., 400 v. cond.
RFC_1, RFC_2, RFC_3, RFC_4—R.f. choke, 2½ mh. @ 125 ma.
RFC_5, RFC_6—Parasitic suppressor (see text)
RFC_7—R.f. choke, 2½ mh. @ 250 ma.
Crystal—160 meter crystal
PL_1—Dial lamp
T_1—Single-button to grid trans.
Mic.—Single-button microphone
B_1—Microphone battery (single flashlight cell)
J_1—Closed circuit jack
S_1—S.p.s.t. sw.
L_1—60 t. #22 d.c.c. closewound on 1¼" form, center-tapped
L_2—90 t., c.t., #22 d.c.c. closewound. 2¼" i.d. self-supporting. The two equal windings to be 1¼" apart
L_3—14 t. #20 d.c.c. closewound on 2¼" form
L_4—Loop of pickup wire inside L_3 (see text)
V_1—6AG7 tube
V_2, V_3—807 tube V_4—6L6 tube

Fig. 2. Schematic diagram of 160 meter rig. In using the clamp tube modulator it is important to have plenty of antenna coupling, in fact, more than that normally used with other types of modulators. A separate power supply is required.

Under chassis view of the 160 meter rig using clamp tube type modulator.



Converting The RCA-730 TV1 and TV2*

By
ROLAND KEMPTON
Editor, "Techni-talk"

Fig. 1. RCA Model 730 TV2 after being converted to use a 14CP4 rectangular CR tube.

Complete details for converting a well-known 10" television set to use a 14" rectangular CR tube.

FOR the past several months we have been publishing information on converting some of the early, small-screen television sets for use with the larger tubes.

This month's conversion covers the *RCA* Models 730 TV1 and 730 TV2, a radio - phonograph - television receiver using a 10" tube. A photograph of the Model 730 TV2 after conversion is shown in Fig. 1. The Model 730 TV1 uses the same chassis in a slightly different cabinet.

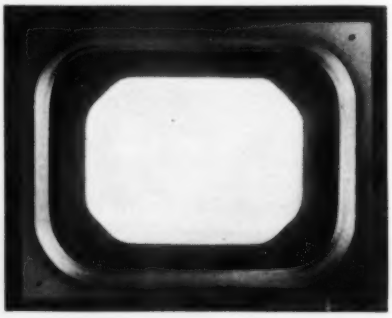
Due to the limited cabinet space in the Model 730 TV2, the *General Electric* 14CP4 fourteen inch rectangular picture tube was the largest size that could be used without major cabinet changes. Because of the size and weight of this combination receiver, only the TV chassis and the front panel, shown in Fig. 2, were removed from the customer's home.

First, the 50 degree deflection yoke was replaced with a 70 degree deflection yoke such as the *Todd*-J-70, *Merit* MD1, or *Stancor* DY-7. The old yoke was used as a wiring guide. It is also necessary to remove the high voltage compartment shield and replace the horizontal sweep transformer in order to obtain sufficient width with good horizontal linearity. A *Stancor* No. A-8128 unit was used, however, a similar type such as the *Stanwyck* No. 998 may be used with equal success. A No. 979, listed as a separate item in the *Stanwyck* catalogue as the replacement coil windings for the No. 998 transformer, may also be substituted for the original windings. Replacing the windings on the original horizontal sweep transformer will result in a considerable saving over replacing the entire unit. The width control was not used and the two wires were taped and not reconnected into the circuit.

A 500 $\mu\mu$fd. condenser was connected across the horizontal windings of the yoke. This connection was made between the center terminal of the horizontal centering control and pins 4 and 6 of the 5V4G damper tube. The 6BG6G screen resistor was changed from 4700 ohms to 17,000 ohms and the "B+" side was connected to the "B+" boost voltage which was available at terminal 1 on the horizontal sweep transformer. The "B+" side of the 1000 ohm resistor (R_{150}) in the vertical output transformer circuit was also transferred to the "B+" boost voltage.

A piece of shielding was attached to the graphite coating on the picture tube, using several pieces of *Scotch* tape. The other end of the shielding was fastened to the chassis when the picture tube was inserted to provide a ground connection.

Fig. 2. Front panel close-up of the TV receiver shown in Fig. 1. The 10" and 14" masks show the increased size obtained.



The ion trap magnet coil could not be used due to the fact that the neck of the 14CP4 is shorter than the 10BP4 with which the set was originally equipped. This was not disconnected, however, as it was part of the negative voltage supply circuit. It was taped to the chassis and a new *General Electric* Cat. No. RET-003 ion trap magnet was used as a replacement.

The 14CP4 picture tube was inserted and the necessary electrical connections were made. It was necessary to adjust the horizontal drive and horizontal linearity controls as well as the height and vertical linearity controls in order to provide a symmetrical test pattern.

Cabinet Changes

The front panel which was removed from the cabinet is shown in Fig. 2 with the old 10" mask in back of the new plastic 14" mask. This panel was marked with a scriber using a 14" cardboard template which was centered over the old opening. This template was made by using the larger perimeter of the beveled portion of a 14" mask for size. Incidentally, these templates should not be discarded but kept for future use. The section marked off was cut out using a keyhole saw. Four holes were drilled and countersunk as shown in Fig. 2 and the plastic mask was mounted onto the wooden panel, using four small brass screws.

The chassis and front panel were returned to the customer's home and placed in the cabinet. The inside wooden panel which supports the bell of the picture tube was also changed

(*Continued on page* 115)

* These conversion notes originally appeared in the December-January 1951 issue of General Electric Company's copyrighted publication "Techni-talk."

A 2 Meter Transmitter-Receiver for Civil Defense Operation

Although originally designed for civilian defense, this rig can be used for general 144 mc. operation.

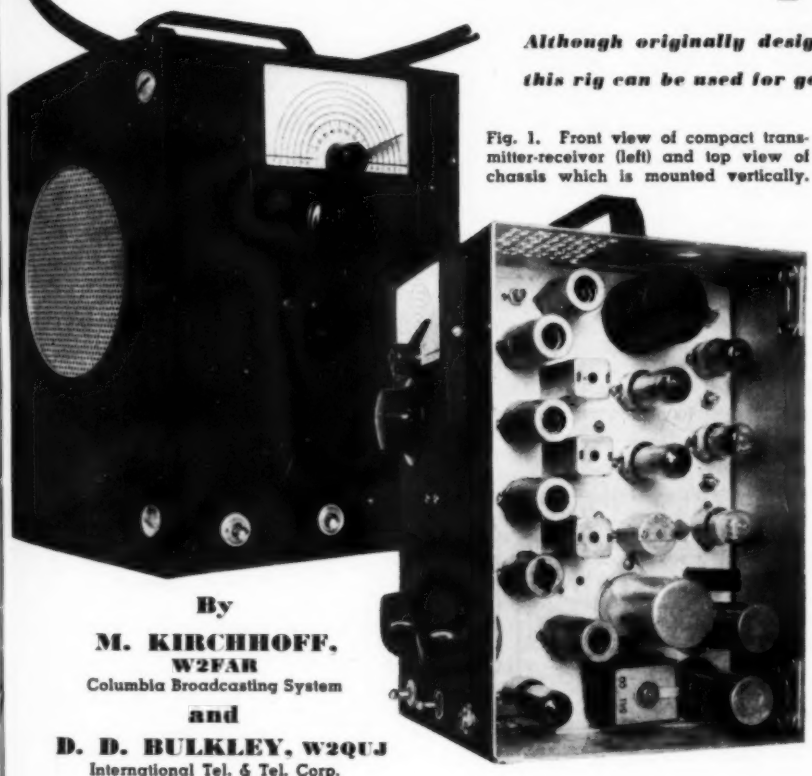


Fig. 1. Front view of compact transmitter-receiver (left) and top view of chassis which is mounted vertically.

By

M. KIRCHHOFF, W2FAR
Columbia Broadcasting System

and

D. D. BULKLEY, W2QUJ
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ALTHOUGH this compact transmitter-receiver unit was designed primarily for Civil Defense network operation, it may also be used in virtually all types of amateur operations in the 144- to 148 megacycle frequency range, with excellent results. These include portable, mobile, and emergency operations or just "rag-chewing" from the home station. Extremely small and compact, the transmitter, receiver, and power supply are housed in a portable cabinet 9½ inches high, 7 inches wide, and 6½ inches deep. It weighs less than seven pounds.

The receiver, an extremely selective and stable superheterodyne, uses miniature tubes and components. An i.f. as well as an a.f. gain control is provided to permit reception of very strong local signals without overloading the second detector. The audio output of the receiver is ample to drive the self-contained five-inch loudspeaker to several watts.

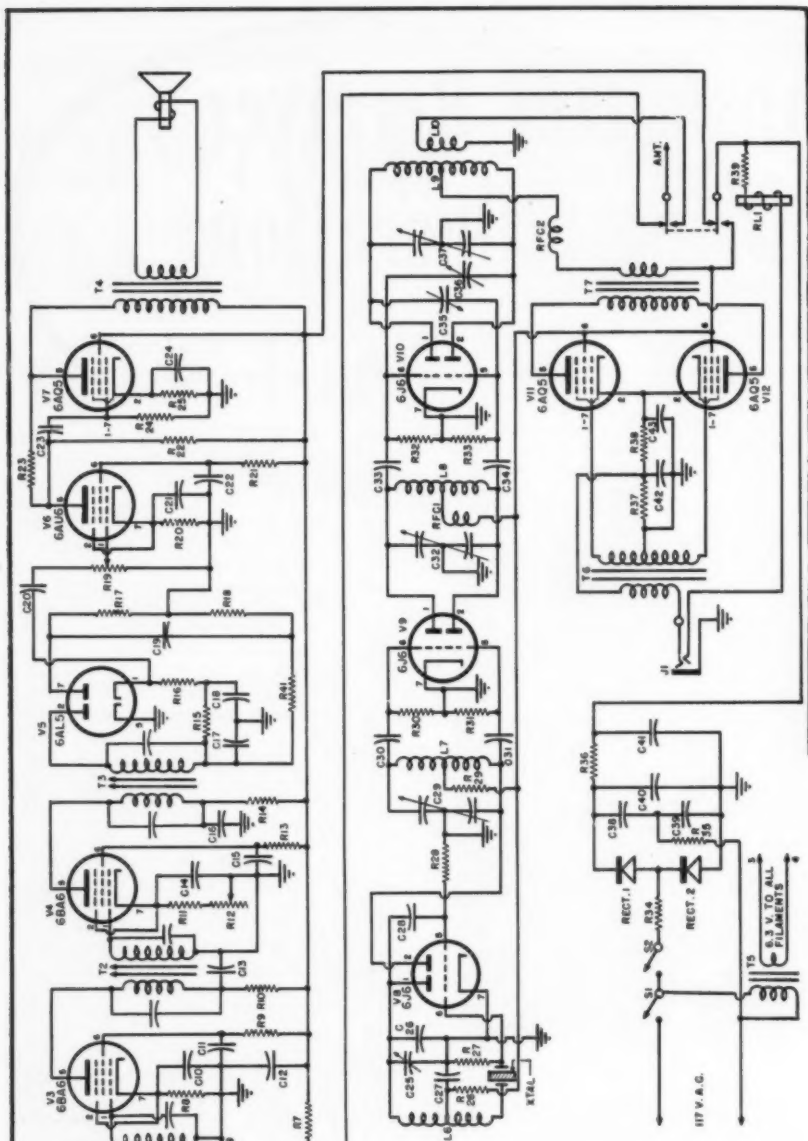
The transmitter, which is crystal-controlled, uses miniature tubes and components throughout. It provides over five watts of output r.f. power with excellent modulation quality. The antenna may be mounted directly on the cabinet or, in the case of a remote beam antenna, may be fed by coaxial cable.

The power supply is an efficient, stable, voltage-doubling, full-wave selenium rectifier circuit. Selenium rectifier power supplies are becoming more and more popular, largely because of the space-saving factor, ease of operation, and the fact that no rectifier filament voltage is necessary. These features far outweigh the small amount of extra care needed to install and operate them.

The transmitter-receiver unit was designed for 117-volt a.c. power input so that it could be used in the home station as well as for emergency operation. For operation away from 117 volt a.c. mains, a miniature vibrator power supply unit such as that marketed under the trade name of "Trav-electric," is ideal. Units such as this may be operated from any six-volt storage battery and will deliver an output of 117 volts, 60 cycles, at better than 35 watts, which is more than ample to supply the power requirements of both the transmitter and the receiver. In addition, these units are available with an adapter that plugs into the cigar-lighter socket on the dashboard of any automobile.

Referring to Fig. 1, it may be seen that all receiver controls are conveniently located on the front panel. The i.f. gain control is located on the left side of the front panel and the a.f. gain control at the right. The filament and primary switch is placed at the lower left, while the plate voltage switch is mounted in the center at the bottom edge of the panel. The microphone input jack is mounted at the lower right-hand corner. A type 10039 *Millen* dial mounted in the center of the front panel for receiver tuning was found to be ideal in size and facility, and also pleasing and professional in appearance. As the transmitter was designed for crystal-controlled network operation, no transmitter controls were brought out to the front panel. This precludes the possibility of the tuning controls being accidentally knocked out of adjustment when the transmitter is operating as a portable or mobile unit. These controls are, however, easily accessible by simply removing one of the "snap-lock" side covers of the cabinet. Once the transmitter is tuned up there is no need for further adjustment, except when changing crystals.

Mechanically, the transmitter and the receiver are laid out in a manner that allows short leads and compact construction. There are no cramped corners to make wiring or servicing difficult. The cabinet formerly housed the "gold-plated" u.h.f. test oscillator, so widely advertised by surplus outlets. This cabinet provides "snap-lock" covers for the two sides of the equipment with a convenient metal-carrying handle on the top. The transmitter and the receiver are mounted vertically on a chassis made of heavy sheet aluminum. Flanges are bent at the top and bottom ends of the chassis and it is bolted into place. Alternatively, a



R_1—200 ohm, ½ w. res.
R_2, R_3—22,000 ohm ½ w. res.
R_4, R_{26}, R_{37}—1000 ohm, ½ w. res.
R_5, R_{15}, R_{16}—1 megohm, ½ w. res.
R_6—10,000 ohm, ½ w. res.
R_9, R_{11}—68 ohm, ½ w. res.
R_{10}, R_{13}—33,000 ohm, ½ w. res.
R_{14}—2000 ohm, ½ w. res.
R_{17}—50,000 ohm pot.
R_{18}, R_{21}, R_{32}—470,000 ohm, ½ w. res.
R_{19}—500,000 ohm pot.
R_{20}, R_{33}—220,000 ohm, ½ w. res.
R_{22}—270 ohm, 2 w. res.
R_{23}—4700 ohm, 1 w. res.
R_{24}—3300 ohm, ½ w. res.
R_{25}—4700 ohm, ½ w. res.
R_{27}—4000 ohm, 1 w. res.
R_{28}, R_{31}—33,000 ohm, ½ w. res.
R_{29}, R_{30}—10,000 ohm, ½ w. res.
R_{34}—20 ohm, 2 w. res.
R_{35}—150 ohm, 5 w. wirewound res.
R_{36}—100 ohm, 1 w. res.
R_{38}—150 ohm, 1 w. res.
R_{39}—15,000 ohm, 1 w. res.
R_{40}—6800 ohm, ½ w. res.
R_{41}—100,000 ohm, ½ w. res.
C_1, C_{12}—5 μμfd. midget var. cond. (Johnson 160-102)
C_2, C_{13}, C_{14}—300 μμfd. ceramic cond.
C_3, C_{29}, C_{36}—47 μμfd. ceramic cond.
C_4—20 μμfd. ceramic cond.
C_5—5 μμfd. butterfly cond. (Johnson 160-203)
C_6, C_{15}—1000 μμfd. ceramic cond.
C_{10}, C_{16}, C_{18}, C_{19}, C_{20}—.05 μfd., 400 v. cond.
C_{17}—100 μμfd. ceramic cond.
C_{24}, C_{27}—.1 μfd., 400 v. cond.
C_{21}, C_{28}—.01 μfd., 400 v. cond.
C_{23}, C_{32}, C_{35}—10/10/10/10 μfd., 50 v. elec. cond.
C_{25}—15 μμfd. var. cond.
C_{26}—33 μμfd. ceramic cond.
C_{27}—680 μμfd. ceramic cond.
C_{28}—15 μμfd. ceramic cond.
C_{30}, C_{31}—11 μμfd. butterfly cond. (Johnson 160-211)
C_{33}—Neutralizing cond. of 72 ohm twin-lead (see text)
C_{34}—40 μfd., 450 v. elec. cond.
C_{37}—40/40 μfd., 450 v. elec. cond.
RFC_1, RFC_2—R.f. choke (Ohmite #Z144)
$Rect._1$, $Rect._2$—5-plate, 100 ma. selenium rectifier
S_1, S_2—S.p.s.t. toggle sw.
J_1—Mike jack 3 connector (Mallory Type 702-B)
RL_1—See text
T_1, T_2, T_3—10.7 mc. i.f. trans. (Automatic 1607)
T_4—Universal output trans. (Stancor A3836)
T_5—Fil. trans., 6.3 v. @ 4 amps.
T_6—Microphone trans. ("Ouncer")
T_7—Mod. trans. 10,000 ohm p. to p. to 4000 ohm (Stancor A3812) Surplus trans. used
Spkr.—5" PM speaker
Xtal—8 mc. fundamental
L_1—2 t. #18, airwound, at gnd. end of L_2
L_2—3 t. #18, airwound, 7/16" dia., 3/8" long
L_3—3 t. #18, airwound, 7/16" dia., 3/8" long, at gnd. end of L_4
L_4—4 t. #18, airwound, 3/8" dia., 1/2" long
L_5—5 t. #18, airwound, 3/8" dia., 1/2" long
L_6—14 t. #18, airwound, 1/2" dia., 7/8" long, tapped at 4 1/2 t. from crystal end
L_7—12 t. #18, airwound, 1/2" dia., 1/4" long
L_8—4 t. #18, airwound, 3/8" dia., 3/8" long
L_9—4 t. #18, airwound, 7/16" dia., 3/8" long
L_{10}—2 t. #18, airwound, enmesh in center of L_9
V_1, V_2, V_3—6AK5 tube
V_4, V_5, V_6—6BA6 tube
V_7—6AL5 tube
V_8—6AU6 tube
V_9, V_{10}, V_{12}—6AQ5 tube

sheet of aluminum could be cut to the exact size of the cabinet and mounted in place with small brackets. As the chassis is mounted vertically, removal of the right "snap-lock" side cover provides access to the transmitter controls and vacuum tubes while removal of the left-side cover provides access to the under-chassis wiring.

In the lower part of Fig. 1, the receiver is seen on the left and the transmitter, modulator and power supply on the right. Starting from the top, the receiver consists of a 6AK5 r.f. amplifier, followed by a 6J6, one section of which is used as the local oscillator, and the other as mixer. The 6BA6, next in sequence, is used as a 10-megacycle i.f. amplifier. This is followed by a second 6BA6 i.f. amplifier. The three miniature i.f. transformers may be seen here. Following the i.f. amplifier is a 6AL5 second detector/noise limiter. The diode section of the 6AL5 provides excellent noise suppression, so essential in mobile operation. The second detector feeds a 6AU6 audio amplifier, followed by a 6AQ5 beam power audio output stage.

The transmitter is located at the right-hand side of the photograph just above the three large condenser cans.

Fig. 2. Complete schematic diagram of the two-meter, self-contained transmitter-receiver.

A 6J6 harmonic oscillator doubler, utilizing an 8-megacycle overtone crystal, provides output at 48-megacycles. This is fed to a 6J6 push-pull frequency tripler. The tripler delivers a 144 to 148 megacycle (depending upon fundamental crystal frequency) signal which drives a single 6J6 push-pull final amplifier. The final amplifier may be safely loaded to over seven watts' input. The modulation transformer is seen at the top of the photograph next to the 6J6 final amplifier tube with the two push-pull 6AQ5 modulator tubes directly below it. A single-button carbon microphone is used because of its high output. This eliminates the necessity of speech amplifier stages. In order to do away with the necessity for a battery the circuit R_{37} and R_{38} in the cathode of the 6AQ5 modulators provides the required voltage to power the microphone.

Construction-wise, the transmitter and receiver were built with extreme care given to keeping all leads as short as possible. It is also important to use a common ground point for all ground connections. Independent circuit grounds and long ground wires frequently form tuned circuits with stray wiring capacities and produce annoying spurious oscillations.

Coil winding information will be found in the parts list. Self-supporting coils were selected so that the coils, when mounted in the equipment, may be compressed or expanded to produce minor inductance changes when tuning up. After aligning operations, however, several coats of coil dope should be applied to the coils so that their inductance will not change during operation due to vibration, etc.

A five-inch loudspeaker is mounted on the left side-cover. A hole slightly smaller than the loudspeaker is cut, and covered with wire screen material to protect the speaker. A short length of 300-ohm twin-lead is used to feed the loudspeaker. One end of this cable is terminated by a crystal adapter plug which fits into a crystal socket. This crystal socket is mounted on the underside of the equipment chassis. With this arrangement, it is possible to remove completely the side-cover containing the loudspeaker.

In mounting the power supply C_{28} must be insulated from the chassis, otherwise the voltage doubler circuit will be shorted to ground. This necessitates that C_{29} and C_{28} be separate units.

The 6J6 final amplifier tube is simply and effectively neutralized by using two-inch lengths of 72-ohm twin-lead. The capacity between the two conductors of this line is sufficient to neutralize the final amplifier.

An ordinary 117-volt a.c. antenna and power changeover relay would have been impractical for use in this equipment due to the high current drawn by the relay coil. Therefore, a very unique and simple relay circuit was used. A *Leach* type 1077-CBF relay was chosen as it had the correct contact arrangement and h.f. insulation. The relay coil was replaced by a *Leach* coil number 361 (removed from a *Leach* type 1251 relay in our case). The number 361 coil has a resistance of 10,000 ohms and is designed for 120 volt d.c. operation. In the circuit diagram R_{39} drops the d.c. plate voltage to approximately 120 volts, which is sufficient for correct operation of the revamped relay. The current drawn by the relay circuit is less than 10 milliamperes. The two relays used to assemble the changeover relay unit are easily and inexpensively obtained on the surplus market.

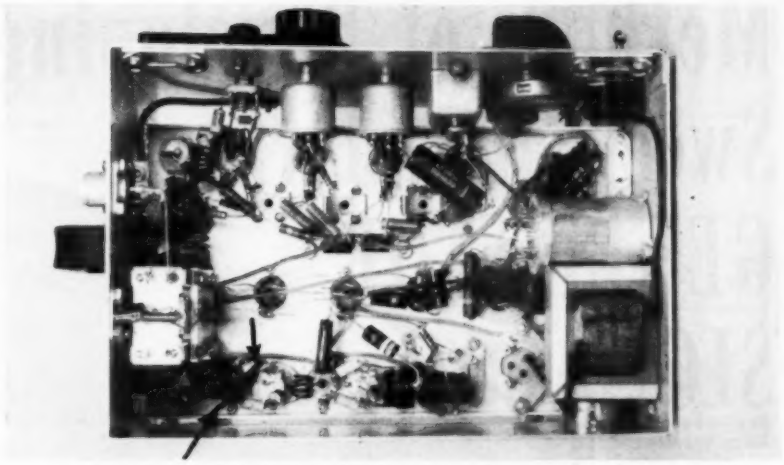


Fig. 3. Bottom view of chassis. Note filament transformer at lower right, loudspeaker receptacle at top right, and antenna relay at bottom left. Short lengths of 72 ohm twin-lead, used for neutralization, are indicated in the photo by arrows.

The antenna output is brought to a coaxial fitting on the top of the cabinet. A dipole, ground plane, or "J" antenna may be mounted directly on the equipment or a 52-ohm coaxial transmission line may be used to feed a remote directional antenna.

The receiver is aligned in the conventional manner, using a signal generator or test oscillator for the i.f. amplifier and another receiver or a v.h.f. signal generator for the oscillator and for dial calibration. In aligning the r.f. stage, C_1 is adjusted for peak output of the stage. After initial setting it may be locked in position.

The transmitter should be tuned up with the aid of a grid dip oscillator, although an accurate wavemeter incorporating a sensitive meter will give satisfactory results. First, the grid dip oscillator or wavemeter is tuned to approximately 24 megacycles and placed near L_7, the plate coil of the 6J6 harmonic oscillator. Condenser C_{25} is then tuned for maximum reading on the test instrument. The test instrument is then tuned to 48 megacycles and held close to L_7 and C_{26} tuned for maximum reading. The test meter is then tuned to the multiple of the fundamental frequency which falls within the two-meter band. It is then placed near the plate coil L_8 of the 6J6 frequency tripler and the plate condenser C_{32} is tuned for maximum reading on the meter. With the test instrument dial setting unchanged, the final r.f. amplifier is tuned for maximum output by placing the meter close to L_9 and tuning C_{37}. Care should be exercised in tuning the final amplifier as a sensitive meter might easily be damaged due to the r.f. power radiated by the amplifier. It is better to start several inches from the final tank coil and move closer until a satisfactory working reading is obtained. If any stage approaches resonance, as indicated on the test instrument with the tank condenser of the stage completely unmeshed, it is an indication that the circuit contains an excess of inductance. The coil should be slightly stretched until it is possible to attain resonance with the condenser approximately half-meshed. Conversely, if resonance is approached with the tank condenser completely meshed, it is an indication of insufficient inductance. The coil should then be slightly compressed so that resonance will occur with the condenser approximately half-meshed.

As previously stated, the final 6J6 r.f. amplifier is neutralized by two-inch lengths of 72-ohm twin-lead placed in the circuit as the C_{36} and C_{35} neutralizing condensers. Neutralizing procedure is as follows: With the plate and filament voltages to the 6J6 final amplifier applied, and with the 6J6 frequency tripler removed from its socket so that no excitation is applied to the grid of the final, place the test instrument, tuned to the output frequency, close to the final tank coil. Upon tuning C_{37} through its range, there will appear, at some point in its tuning range, a reading on the meter. The two lengths of 72-ohm line should be carefully pruned, one-eighth inch at a time, until no reading appears on the test instrument. The stage is now completely neutralized, and there should be no indication on the meter, no matter where the tuning condenser is turned. Neutralization should occur when the pieces of 72-ohm line are approximately 1⅝ inches long.

—30—

Methods of Developing Sweep and Marker GENERATOR SIGNALS

By
CYRIL H. BROWN
Kay Electric Company

Over-all views of the "Mega-Sweep" (left) and the Model I.F. "Marka-Sweep" (right), both manufactured by Kay Electric Co. of Pine Brook, New Jersey.

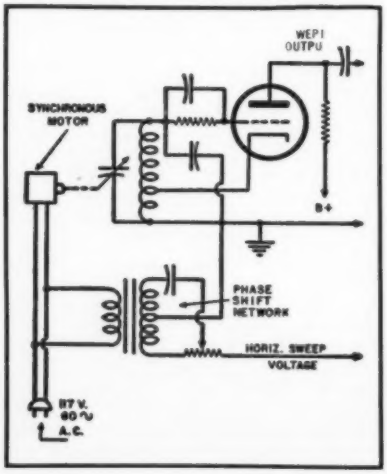
Details on some of the most common techniques used to obtain sweep and marker frequencies.

THE use of broadband amplifier systems in television and radar has encouraged the development of a series of instruments especially applicable to the alignment of such amplifiers. The r.f. sweep generator, a laboratory tool only a few years ago, has become a necessity on the workbench of every television technician, along with the voltmeter, the single frequency c.w. signal generator, and the oscilloscope.

Many different methods of causing the frequency to vary through the desired range have been devised. Probably the earliest of these is illustrated in Fig. 1. In this system the frequency sweep is provided by a motor-driven variable condenser connected across the tuning capacitance of a conventional *LC* tuned r.f. oscillator. Usually the plates of the rotating condenser are so shaped as to provide a sinusoidal variation of frequency, and motor speed is selected so that frequency modulation is at the power line frequency. The horizontal axis of the oscilloscope is usually driven by a 60 cycle sine wave derived from the power line through a variable phase shift network. This phase shifter is necessary to allow proper overlap of the two amplifier response curves on the oscilloscope screen. A response curve is drawn out separately for each positive and negative frequency change. The phasing network allows moving of these two patterns relative to each other until they are superimposed. This sweep generator system suffers from an obvious disadvantage, since a motor driven condenser must operate at all times while the sweep generator is in use. Contact and bearing difficulties have held the maintenance cost of such instruments at a comparatively high level.

A great improvement on the basic motor driven system was made when the rotating motor was replaced with a moving coil (in magnetic field) similar to the PM loudspeaker mechanism. This system, still extensively used, is less expensive to maintain than its predecessor, but still requires the use of phasing networks for proper picture adjustment.

Fig. 1. Sweep signal generator using a motor-driven variable condenser.



The first of the all electronic sweep generators was the *Kay Electric Company* "Mega-Sweep," a schematic diagram of which is shown in Fig. 2. This instrument uses two 723A/B klystrons working in the 10,000 megacycle frequency range in a beat frequency system. One klystron is operated at a fixed frequency, while the frequency of the other may be varied up to 1000 megacycles away from the fixed oscillator by adjusting the front panel controls of cavity tuning and repeller voltage. The variable frequency oscillator is also swept in frequency by the application of a saw-tooth oscillator signal in series with the repeller voltage supply. The r.f. output of the klystrons is fed through an assembly of ¾" x 1½" waveguide which consists of a waveguide section for each klystron, resistor card waveguide terminations and attenuators, and a directional coupler to get both klystron signals into one waveguide. The mixer is a 1N23B crystal detector inserted into the waveguide, and connected directly to the output terminals through a very short bus wire. Frequency adjustment and measurement is done by means of a very accurate coaxial wavemeter which is coupled into the waveguide system. The use of the extremely high frequency for the individual oscillators as well as the waveguide distribution system assures the user that none of the individual oscillator signal will appear in the output.

The all electronic sweep generator has a great advantage in that its internally generated sweep saw-tooth may be synchronized to the power line frequency or varied in frequency to allow easy detection of hum in the circuit under test. The greatest feature of the "Mega-Sweep" system, how-

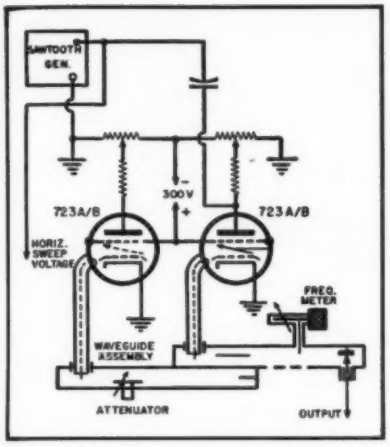


Fig. 2. Wiring diagram of the "Mega-Sweep."

ever, lies in its ability to tune between 50 kilocycles and 1000 megacycles as well as to vary its sweep width continuously between zero and 30 megacycles. Automatically perfect sweep synchronization and adjustment of the oscillograph picture is obtained by sweeping the oscillograph beam with the same saw-tooth voltage that sweeps the oscillator frequency. Although newer sweeping methods have been devised, none has yet proved as versatile.

The most promising of the newer sweep systems was first introduced some time ago, but appears in its most refined form in the *Kay* "Marka-Sweeps" and the "Rada-Sweep." In this method the sweep is obtained by varying the permeability of the core of the r.f. oscillator coil in accordance with an applied saw-tooth signal. A basic schematic diagram of such a system is shown in Fig. 3. An oscillator circuit configuration of any type may be used, having the frequency determining circuit L_2C_1. A ferromagnetic core P_1 is inserted into the inductance L_2, and a conventional transformer lamination stack P_2 is arranged so that its magnetic circuit is closed by the r.f. oscillator core P_1. The saw-tooth generator applies a signal to magnetizing coil L_1, the function of which is ultimately to set up a saw-tooth variation of magnetic intensity in the r.f. oscillator coil core P_1. This variation of magnetic intensity causes a saw-tooth modulation of the permeability of core P_1, thus modulating the inductance L_2, and the resonant frequency of circuit L_2C_1.

This method provides an ideal solution for a production and service alignment instrument for television and radar. Although instruments using this system do not have the great versatility of the klystron beat frequency oscillator, many other advantages are apparent. Conventional vacuum tubes are used throughout. Sweep widths of 15 and 20 megacycles and more are easily attained even at the commonly used intermediate frequencies. Frequency and amplitude linearity are exceptionally good, assuring accurate reproduction of the response curve.

Of major importance in the use of a sweep signal generator is the availability of accurate and easily readable frequency marks. The simplest and historically earliest type of mark is the so-called "birdie." This mark is produced by feeding the output of a c.w. signal generator to the set under test in parallel with the sweep signal. At the detector of the set the c.w. signal mixes with the sweep signal and produces the audio "birdie" marker on the oscillograph pattern once each sweep cycle, as the swept oscillator frequency passes through the c.w. oscillator frequency. This birdie marker system suffers from several serious disadvantages:

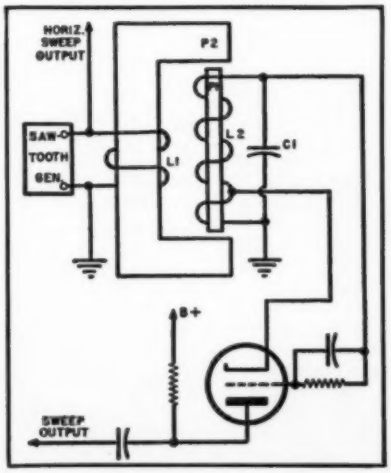
1. Because of phase variations the birdie marker varies rapidly in amplitude, and is rather difficult to observe;

2. Since a high level c.w. signal is often necessary to produce a mark of visible amplitude on the oscilloscope display, there is always danger of overloading the set under test and thus distorting its true response curve;

3. The birdie mark can not be used satisfactorily to align trap circuits, since the c.w. signal must be set to the trap frequency; the c.w. signal is thus absorbed in the trap, and is not present in the output to produce the mark.

The second type of mark in common use is a pulse type marker which collapses the displayed pattern to zero at the marker frequencies as indicated in Figs. 4A and 4B. To obtain this mark, a birdie signal similar to that described previously is usually developed in the generator. The birdie is detected, shaped, amplified, and finally connected to the sweep oscillator circuit in such a way as to disable the oscillator for a short period of time, causing the r.f. output to drop to zero for an instant. Although the mark is primarily a frequency mark, the circuits perform the function of creating a timed mark, with reference to the horizontal sweep axis. Although a great improvement over the simple birdie mark in that no c.w. signal passes through the

Fig. 3. Sweep generator using permeability modulation of the oscillator core.



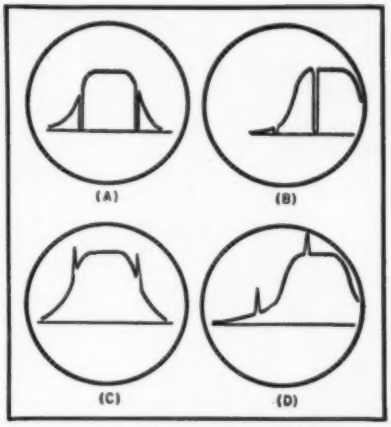


Fig. 4. Patterns illustrate aligned (A) and misaligned (B) amplifier, using a pulse type marker which disables oscillator; aligned (C) and misaligned (D) amplifier using an independent pulse type marker.

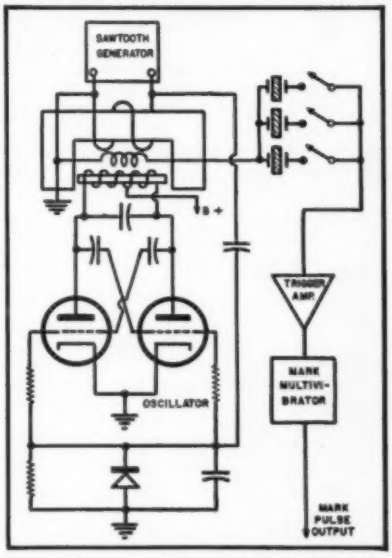


Fig. 5. Diagram of "Marka-Sweep" Model I.F.

device under test and that mark stability and visibility is greatly improved, this marking method does suffer from certain disadvantages:

1. Serious misalignment of the amplifier unit under test can result in inability to see marks.

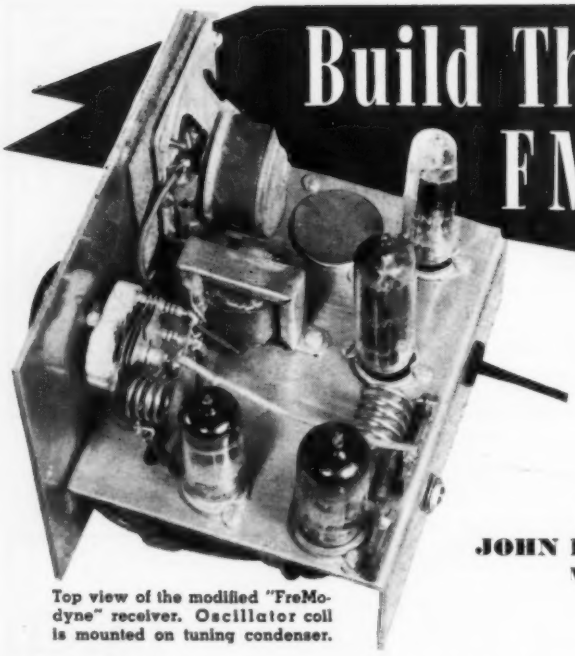
2. Regeneration and oscillations in the unit under test can obliterate marks.

3. Mark level is not independently adjustable.

The most recent development in marker circuits has resulted in the independent pulse type marker. In this system a series of crystal filters is connected to the output of the sweep oscillator. As the sweep oscillator passes through a crystal frequency a small burst of energy is transmitted by the crystal. This signal (a high frequency birdie) is rectified and amplified and triggers a blocked multivibrator, the output of which is fed directly to the vertical terminals of the test oscillo-

(*Continued on page* 91)

Build This Low-Cost FM RECEIVER



Top view of the modified "FreModyne" receiver. Oscillator coil is mounted on tuning condenser.

Construction details on a simple, four-tube FM receiver that anyone can build without special tools or test equipment.

By
JOHN F. CLEMENS,
W9ERN

IF YOU live within 40 miles of an FM station and you are not now enjoying an FM receiver or if you are looking for an interesting and worthwhile small project, you should build this four-tube FM receiver. It is simple enough to be attempted by the beginner in radio and the performance will make it an attractive project for the veteran radio builder. The construction of the average FM receiver, a maze of ever-oscillating i.f. stages and cantankerous discriminators, is a job which may well cause the home constructor to pause. But this simplified circuit eliminates most of the critical adjustments and the gain in any one part of the receiver is too low to give oscillation troubles. If the coil specifications are followed closely there is no reason why this set cannot be built and put into operation without test equipment of any sort.

The basic circuit is an outgrowth of the "FreModyne" which was described in February, 1948 issue of RADIO NEWS. Several "FreModynes" were built and, despite the fact that the complicated circuitry defied our understanding, the results were excellent. It appeared that a less complex circuit should accomplish the same results and save parts as well. The circuit which resulted from considerable experimentation has achieved this reduction in components at no sacrifice in performance. As a result, the set is less costly to build than the original "FreModyne." An a.c.-d.c. power supply is used to save space and money by elimination of the power transformer, and at the same time, the one usual disadvantage of the a.c.-d.c. supply, a chassis "hot" with 110 volts, has been avoided. A metal cabinet is safe and practical.

Although this set is constructed in a 4x5x6 inch utility box without undue crowding, it may be desirable to use a slightly larger box, say 9x5x6, especially if a larger speaker is used. The 2x3 oval speaker shown is not necessarily the best choice for the job since it has poorer quality and efficiency than larger speakers, but it is about the largest size that can be easily fitted into the cabinet. A 4x4 PM speaker is recommended as somewhat superior and it can be most easily fitted into the larger size utility box. For those who do not have facilities to bend a chassis, a line of utility boxes is available from *ICA* which include the chassis.

The circuit uses one half of a 12AT7 as combination mixer and superregenerative detector at 21.75 mc. The FM signal is introduced into the mixer grid circuit along with the local oscillator signal by coupling the antenna to L_1, which is resonant with the tube and circuit capacity at 100 mc. It has been determined experimentally that there is no practical advantage in tuning this coil with the tuning condenser, so the added expense of a two-gang tuning condenser is avoided. To obtain the proper "Q" in the 21.75 mc. slug-tuned coil (L_2) for good slope detection of FM broadcast stations some loading of the coil is necessary. In the original "FreModyne" a resistor was connected directly across the coil to give this loading. In this version, the detector plate load resistor provides the required loading and thus dispenses with one component. Similarly, in the original circuit a Colpitts oscillator circuit was used with a pair of condensers providing the cathode tap on the tuned circuit, while in this circuit the coil is tapped, saving one condenser. Other parts which have been eliminated are two r.f. chokes, a decoupling resistor and bypass condenser, and an 8 μfd. electrolytic condenser.

The circuit has been arranged to use the second half of the 12AT7 as the audio stage rather than the more usual connection of this section acting as the local oscillator, to derive the benefit of the high gain of the 12AT7 as an audio amplifier. As a result, the audio gain of the first audio amplifier is sufficient without a cathode bypass condenser, a further saving.

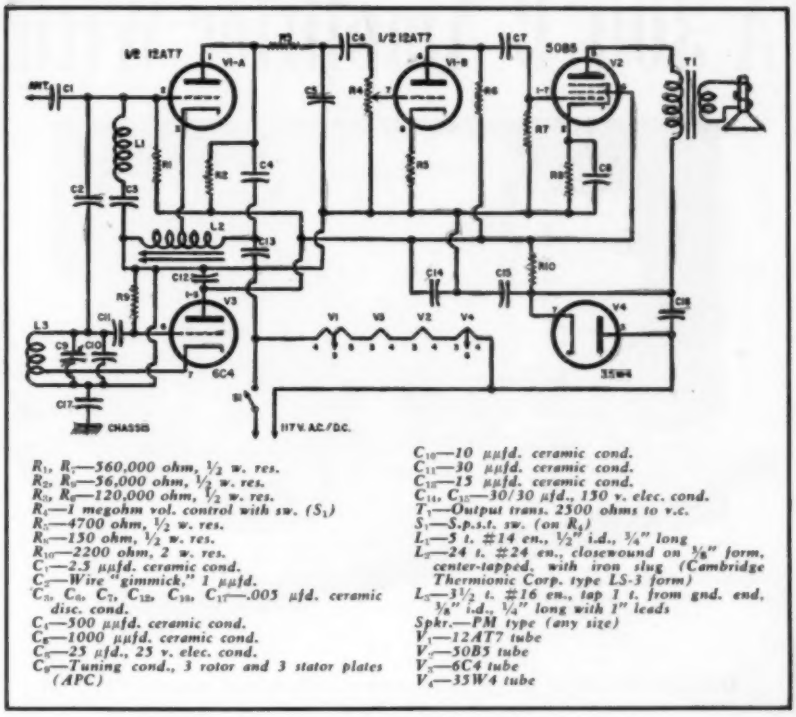
The local oscillator is a 6C4, tuning from 66 to 87 mc., to beat with the incoming FM signal to produce the intermediate frequency of 21.75 mc. A ceramic socket should be used for the 6C4 to insure strong oscillation, although the other tube sockets may be of bakelite or any other type.

A 50B5 audio output tube drives the output transformer and PM speaker to good room volume and a 35W4 is used as rectifier. During the development of the circuit, a severe hum occurred as a modulation on all received signals, completely defying filter and bypass condensers. It was finally discovered that a .005 μfd. bypass condenser (C_{10}) across the rectifier eliminated the hum. There is no apparent reason for the requirement of this condenser; just another example of how a.c.-d.c. receiver design is still as much art as science. A resistance-capacity filter gives adequate filter action provided the filter condensers are sufficiently large. Thirty microfarads per section or more is adequate and a condenser can be obtained which includes a 25 μfd., 25 volt section for use as C_{11}. The output transformer should be chosen to match the 50B5 (2500 ohms) to the voice coil of the speaker used, usually 4 ohms.

The only critical aspects of the construction are in duplicating the r.f. coils and tuning ranges. If the coil specifications and photographs are followed closely this should present no particular difficulty. The oscillator coil should be wound exactly as shown and mounted on the tuning condenser terminals. The tuning condenser is an *APC* type, widely available on the surplus market, and has a capacity range of approximately 15 μμfd. It is important that the .005 μfd. condenser, C_{11}, be connected from the tuning condens-

er rotor terminal to the metal panel of the receiver right at the rotor terminal, using a soldering lug under one of the screws which mount the tuning condenser, to avoid hand capacity effects and produce the proper tuning range of the oscillator. Another .005 μfd. bypass condenser, C_{13}, should be connected from pin 1 of the oscillator tube socket (the plate of the 6C4) to the negative plate supply lead with short connections. L_2, the superregenerative detector coil, is wound on a ⅜ inch diameter form with an iron slug. A suitable form is a *Cambridge Thermionic Corp.* type LS-3. This coil is tuned to 21.75 mc. so that the fourth and fifth harmonics of the superregenerative detector fall just below and above the FM band, respectively, and do not fall in the tuning range of the receiver where they would otherwise appear as spurious responses. The signal input coil, L_1, may be adjusted slightly by squeezing or spreading the turns and checking with a grid-dip oscillator to set the resonant frequency to 100 mc., but the improvement in performance due to this refinement is so small that it may be ignored if no grid-dip oscillator is available. The tuning of this coil is so broad that there is no need to worry about slight imperfections in it. It would be wise also, to wire the heater string in the sequence shown on the diagram, otherwise hum may be introduced.

Other parts of the circuit are definitely non-critical. The values of resistance and capacity shown are the actual values used in this set, but wide latitude is permissible if the junk box is better stocked with other values. For instance, the 56,000 ohm resistors in the circuit could just as well be replaced with 47,000 or 68,000 ohm units without noticeable effect. Any of the new ceramic bypass condensers, either tubular or disc types, are excellent for construction such as this, and are highly recommended. They are smaller than the old tubular paper condensers and have lower leakage and lower lead inductance. The oscillator signal is injected into the mixer grid by means of a "gimmick," a short piece of hookup wire soldered to the grid end of L_1 and wrapped one turn around the oscillator lead as shown. This capacity is not at all critical.



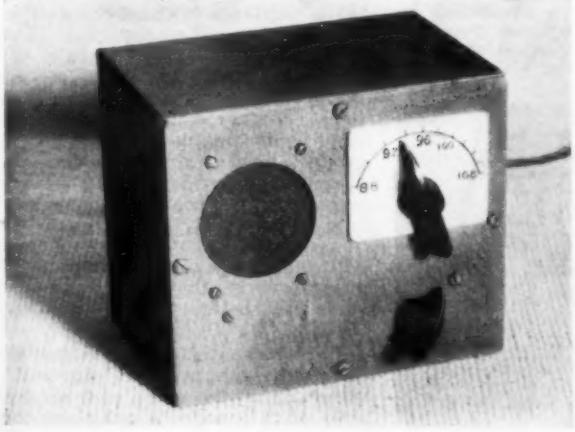
R_1, R_7—560,000 ohm, ½ w. res.
R_2, R_6—56,000 ohm, ½ w. res.
R_3, R_8—120,000 ohm, ½ w. res.
R_4—1 megohm vol. control with sw. (S_1)
R_5—4700 ohm, ½ w. res.
R_9—150 ohm, ½ w. res.
R_{10}—2200 ohm, 2 w. res.
C_1—2.5 μμfd. ceramic cond.
C_2—Wire "gimmick," 1 μμfd.
C_3, C_{6a}, C_7, C_{12}, C_{13}, C_{17}—.005 μfd. ceramic disc. cond.
C_4—300 μμfd. ceramic cond.
C_5—1000 μμfd. ceramic cond.
C_6—25 μfd., 25 v. elec. cond.
C_8—Tuning cond., 3 rotor and 3 stator plates (APC)
C_{10}—10 μμfd. ceramic cond.
C_{11}—30 μμfd. ceramic cond.
C_{14}—15 μμfd. ceramic cond.
C_{15}, C_{16}—30/30 μfd., 150 v. elec. cond.
T_1—Output trans. 2500 ohms to v.c.
S_1—S.p.s.t. sw. (on R_4)
L_1—5 t. #14 en., ½" i.d., ¾" long
L_2—24 t. #24 en., closewound on ⅜" form, center-tapped, with iron slug (Cambridge Thermionic Corp. type LS-3 form)
L_3—3½ t. #16 en., tap 1 t. from gnd. end, ⅜" i.d., ¼" long with 1" leads
Spkr.—PM type (any size)
V_1—12AT7 tube
V_2—50B5 tube
V_3—6C4 tube
V_4—35W4 tube

Complete circuit diagram of the simple, four-tube FM receiver.

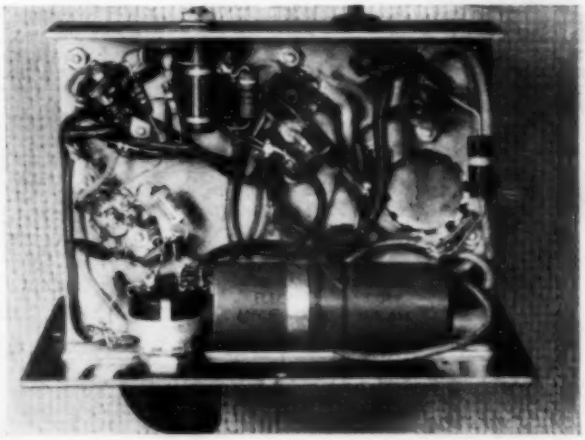
A small aluminum rectangle was used for the dial plate and the frequency calibration was engraved on it with a *Burgess* "Vibra-Tool." A more elaborate dial would improve the appearance but a bar knob is quite satisfactory for easy tuning. A coat of blue wrinkle paint was sprayed on the entire cabinet to produce the finished product.

The sensitivity of the four-tube receiver is truly amazing. FM stations 40 miles away are received consistently with good, useful signals. In fact, the set receives any signal that produces a useful signal in a full-grown, twelve-tube conventional FM set. Two or three feet of wire is an adequate antenna, and the antenna terminal may be connected to the power line if desired with practically the same results as a separate antenna. Local and distant stations are of practically the same strength, due to the inherent limiting action of the superregenerative detector. The only disadvantage of this circuit is the interstation rush, a drawback which it has in common with all superregenerative circuits. Since the rush quiets when a station is tuned in, this is not a serious failing. The receiver is guaranteed to be well worth the small cost in money and effort required to build it—try it and see! —30—

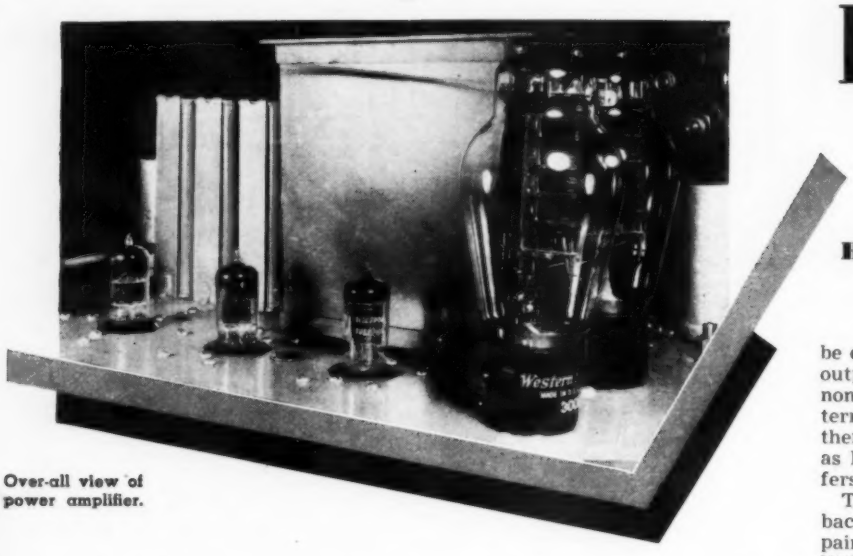
Front view of receiver as built into a 4 x 5 x 6-inch box.



Underchassis view of set. Leads must be short and direct.



A 300-B Amplifier With FEEDBACK DRIVER



Over-all view of power amplifier.

By
HOWARD T. STERLING
Pres., Waveforms, Inc.

Design details on a five-tube, 30 watt amplifier. A rather unusual circuit provides 70 db of feedback.

IN ANY amplifier using low-mu triodes, large amounts of driving voltage are required. The answer to the problem of drive will usually be the key to the success of any particular design. The time-tested technique, in the past, has been to drop in a good input transformer, drive it from a low-mu triode, and hope for the best.

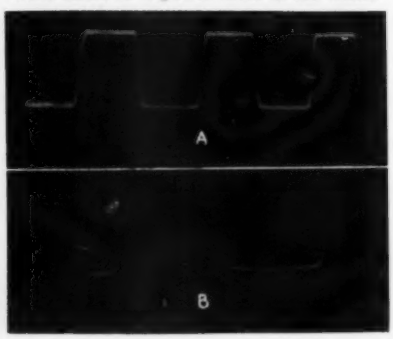
Unfortunately, most discriminating engineers have become unwilling to accept an amplifier design which does not incorporate a fairly large amount of over-all feedback; 20 db is not excessive. This feedback is usually taken from the output transformer secondary to some early point in the drive system. It is virtually impossible to include a second transformer in such a loop and hope for stable operation.

The desirability of feedback of this nature is virtually unquestioned. Without feedback, a 6AS7 may deliver ten watts at nearly ten per-cent distortion; 300-B's will deliver 30 watts at about 5 per-cent. This distortion is much too high by modern standards; 20 db of properly applied feedback will reduce these figures by a factor of ten. Feedback will also considerably improve the damping, which is already good, in a triode amplifier. It is interesting to note in this connection that while most amplifier design engineers strive for even better damping, some of the foremost loudspeaker specialists will recommend a damping factor on the order of 2. Even this is not incompatible with the use of large amounts of feedback. Current feedback, taken from the voice coil circuit, may be used in conjunction with voltage feedback to provide any desired damping. The distortion remains a function of the total feedback.

There are other drawbacks to the use of input transformers. Few transformers afford smooth response in the region above audibility, which is becoming a consideration in modern design, and any transformer will introduce some low frequency distortion.

If we eliminate the input transformer from consideration, we pretty well have to fall back on some sort of resistance-coupled driver. With self bias in the power stage we can tolerate grid resistances on the order of 250,000 ohms. A 6J5 (or 6SN7) with a supply voltage of 400, will deliver about 100 volts peak with distortion on the order of five per-cent. While this is largely even harmonic distortion, and would be cancelled in the plate circuit of the output stage, it nevertheless indicates non-linearity and the probability of intermodulation in the driver itself. Furthermore, this is only as much drive as low-mu tubes may require, and offers no margin of safety.

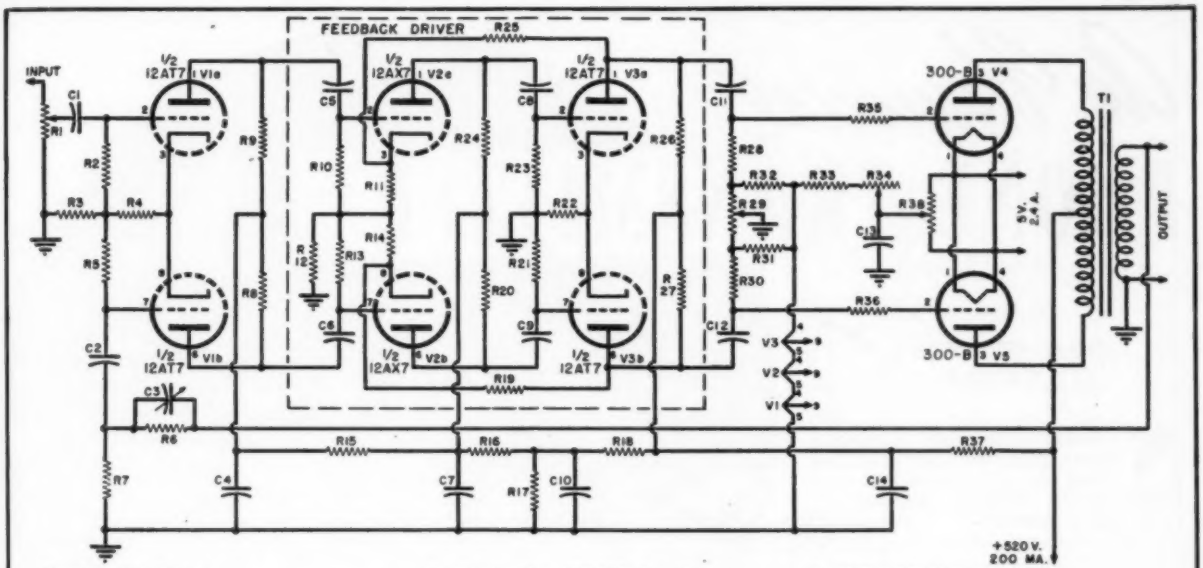
Fig. 1. (A) Square wave performance of the amplifier at 5 kc. (B) Square wave performance at 20 cycles shows excellent low frequency response. These oscillographs were taken at a power level of ten watts.



The obvious solution is to use feedback over the driver. The feedback pair, which has received altogether too little recognition as such in the audio field, is entirely suitable for this application. Fig. 2 shows the circuit of an experimental 30-watt amplifier using 300-B's, for which the feedback driver was developed. In this circuit, initial phase inversion was achieved in a long-tailed pair, such that the resulting unbalance was about 10 per-cent. This is followed by the feedback driver, which consists of two feedback pairs in push-pull, with direct-coupled feedback to minimize low frequency phase shift. The feedback configuration is such that it provides differential balance, and hence effectively eliminates any residual unbalance appearing at the 300-B grids. The only critical elements are the resistors in the feedback circuit, but now that the stable 1 per-cent tolerance English resistors are available at low cost in this country, this presents no problem.

The tube used for the driver in this circuit was the 12AT7. A 6SN7 would have been satisfactory, but the higher mu of the 12AT7 allows more gain within the feedback loop, while its low plate resistance keeps the source impedance low. Actually, the 12AT7 combines most of the virtues of both the high mu and low mu types, and is excellent for general audio applications. Some tube engineers have advised against its use for audio on the grounds that since the grid is very close to the cathode the tube should be very microphonic. Compensatory care is apparently taken in assembly, however, since it compares favorably with other types in this respect. Its appearance is admittedly a little odd when used beside the relatively huge 300-B's.

From this circuit there is available about 140 volts peak *per grid* with a distortion on the order of 1 per-cent, more than enough to drive any tube



R_1—250,000 ohm pot.
R_2, R_5, R_{10}, R_{13}, R_{21}, R_{28}—1 megohm, ½ w. res.
R_3, R_{12}, R_{17}—47,000 ohm, ½ w. res.
R_4—390 ohm, ½ w. res.
R_6—10,000 ohm, ½ w. res.
R_7—100 ohm, ½ w. res.
R_8, R_9, R_{20}, R_{23}—100,000 ohm, ½ w. res.
R_{11}, R_{14}—2000 ohm, ½ w. res.
R_{15}—15,000 ohm, ½ w. res.
R_{16}—5000 ohm, 1 w. res.
R_{18}—7500 ohm, 10 w. res.
R_{19}, R_{25}, R_{26}, R_{29}—270,000 ohm, ½ w. res.
R_{22}—680 ohm, ½ w. res.
R_{30}, R_{37}—30,000 ohm, 4 w. res.
R_{27}—1000 ohm wirewound pot.
R_{31}, R_{35}—2400 ohm, 10 w. wirewound res.
R_{32}—2500 ohm, 20 w. wirewound res.
R_{34}—2000 ohm, 25 w. pot.
R_{33}, R_{36}—1000 ohm, ½ w. res.
R_{37}—1800 ohm, 10 w. wirewound res.
R_{38}—100 ohm wirewound pot.
C_1—.01 μfd., 600 v. cond.
C_2, C_5, C_6—.5 μfd., 600 v. cond.
C_3—100 μμfd. trimmer cond.
C_4, C_7—40 μfd., 450 v. elec. cond.
C_8, C_9—.1 μfd., 400 v. cond.
C_{10}, C_{14}—10 μfd., 600 v., oil-filled cond.
C_{11}, C_{12}—1 μfd., 600 v. cond.
C_{13}—125 μfd., 350 v. elec. cond.
T_1—Output trans. 4000 ohms to 15 ohm v.c., 50 w. (Altec 7M-220A or equiv.)
V_1, V_5—12AT7 tube
V_2—12AX7 tube
V_3, V_4—300-B tube

Fig. 2. Diagram of power amplifier with feedback driver section shown in dotted lines. Any power supply, having an output of 520 volts at 200 milliamperes, can be used. Actually, on this unit, some of the power supply metering and control circuits were incorporated on the same chassis as the amplifier. The transformer, T_1, as used had a split primary. This, of course, is not absolutely necessary. It does, however, provide a simple means of balancing the output stages. The author incorporated two closed circuit jacks in the center-tap legs of the primary windings in order to simplify plate current measurement. These jacks can be seen in the upper right hand corner of the photograph below.

in general use. With suitable precautions, any residual unbalance will be on the order of 1 per-cent or less, which will be negligible compared with the dynamic unbalance of any but a very carefully matched pair of power tubes.

The off grid of the input long-tailed pair provides a very convenient point for the introduction of inverse feedback. Some 20 db of feedback was used over the four stages of this amplifier, including the output transformer. This, together with an estimated 50 db in some four feedback circuits within the amplifier, gives us a system with five loops and a total of some 70 db of inverse feedback.

The application of over-all feedback in an amplifier of this type poses a number of problems. It is extremely important to insure that the use of feedback does not result in instability at either of the frequency extremes.

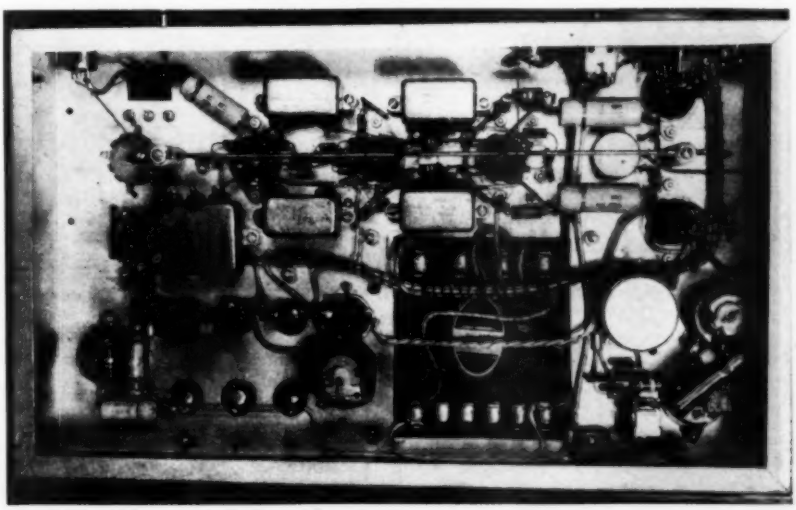
At low frequencies, this instability might appear as a continuous oscillation (or motorboating) at a fraction of a cycle-per-second. If the instability were only slight it might be apparent as a few damped cycles of "recovery" following some signal transient.

Obviously, this instability is caused by phase shifts within the amplifier which are sufficient to make the normally inverse feedback positive, or regenerative. These phase shifts are due, at low frequencies, both to the output transformer and to the coupling condensers. Since the output transformer characteristic is fixed, the best solution is to keep the phase response of the rest of the amplifier flat until the low frequency loss in the transformer has reduced the loop gain to the point where the system can no longer take off. This calls for the use of large time constants in the coupling circuits, and for as few such coupling circuits as possible, since there can be a considerable accumulated phase shift before any serious effect on response becomes apparent.

It is normally easy to maintain low

(*Continued on page* 113)

Bottom view of the five-tube power amplifier. As mentioned previously, the power supply was constructed on the same chassis as the amplifier. The two relays shown at the bottom of the photograph are connected in the power supply circuit and are used as a means of operating the power amplifier from a remote position.



An Unusual PHONE TRANSMITTER

By
BOB PERTHEL,
W9MWD

Fig. 1. Over-all view of transmitter. For parts identification see Fig. 4.

Transmitter described was designed as a mobile unit for the 75 meter band but with a few changes it can be used as an exciter for a 1 kw. final amplifier. It employs an unusual phase modulated AM system widely used by European radio stations.

NUMEROUS methods of modulation have been devised, but good old AM seems to be preferred by the majority of hams. By using the system to be described AM can be obtained without the use of large modulators and the final tubes operate class C at I.C.A.S. ratings. All of the advantages of low level modulation and a greater over-all efficiency than that of conventional plate modulation are realized.

This system makes use of the fact that when two waves of the same frequency, but differing in phase, are mixed, amplitude variations are produced. In Fig. 2 the waves marked *a* and *b* are equal in amplitude, frequency, and phase. When they are added a wave differing only in amplitude equal to the sum of the waves at *a* and *b* is produced. However, when *a* and *c*, both of equal amplitude and frequency but 180° out-of-phase, are added a complete cancellation results.

It should now be understood that when two waves of the same frequency and amplitude, but differing in phase, are mixed the end result can be anywhere between the two limits described.

If a phase modulated wave and an unmodulated wave are mixed, amplitude modulation will be produced but one-half the phase change and consequent frequency change will still be present. This phase change can be made to cancel by phase modulating both waves so that one will lead while the other is lagging. Effectively, then, the frequency of one will be increasing and the other decreasing with the net result that there is no change in frequency. If two oppositely modu-

Fig. 2. Theoretical analysis of wave addition. See text for detailed explanation.

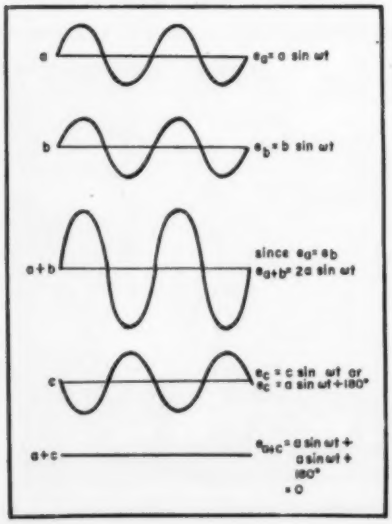
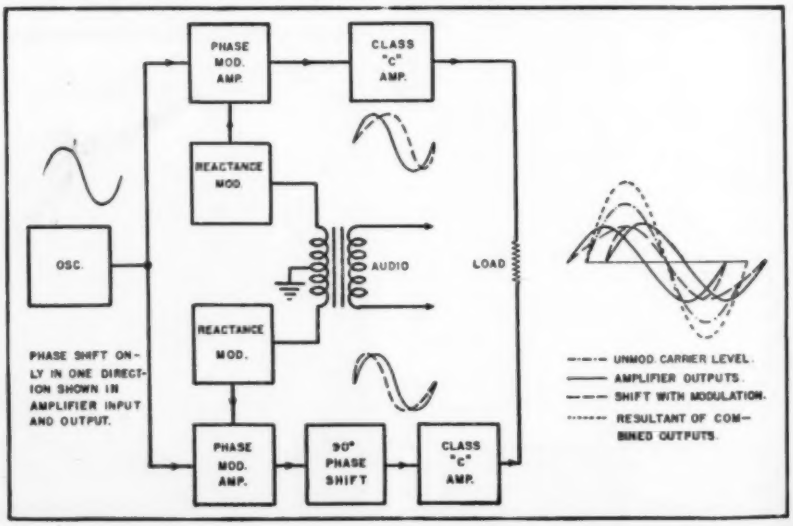


Fig. 3. Diagrammatic representation showing how two waves of same frequency, but differing in phase, are mixed to produce amplitude modulation. See text for analysis.



lated waves are combined 90° out-of-phase, the waveform desired for 100% AM modulation is produced. See Fig. 3.

Figs. 1 and 4 show the transmitter at W9MWD. It was designed for use in the 75 meter band as a mobile unit or, with slight change, as an exciter for a kilowatt final amplifier. It is built on a 7 x 13 x 2 inch chassis and no "trick" or hard-to-reach operating circuits were used. The oscillator is a conventional triode oscillator, using one-half of a 2C51. This tube is a twin triode of the miniature type and could be replaced by a 7F8 or two miniature triodes such as 6C4's. It drives two 6AK6 pentode amplifiers in parallel. The circuit constants permit class C operation of these tubes. The 6AK6's have their plate circuits tuned separately. Center-tapped coils were found desirable in these stages, but neutralization wasn't found necessary. A pair of 2E26's was selected as the output tubes as they require very little drive for full output and, as a consequence, do not lower the "*Q*" of the 6AK6 tank circuits excessively. Driving the two 2E26's 90° out-of-phase is done quite simply by using direct coupling for one tube and inductive coupling for the other. An initial adjustment in the coupling between L_2 and L_4 is necessary, but not critical. The coupling should be adjusted close enough so that the individual outputs of the 2E26's are as nearly equal as possible. Excessive coupling will cause "twin peaks" in the tuning of C_{11} and ruin the operation of the whole unit.

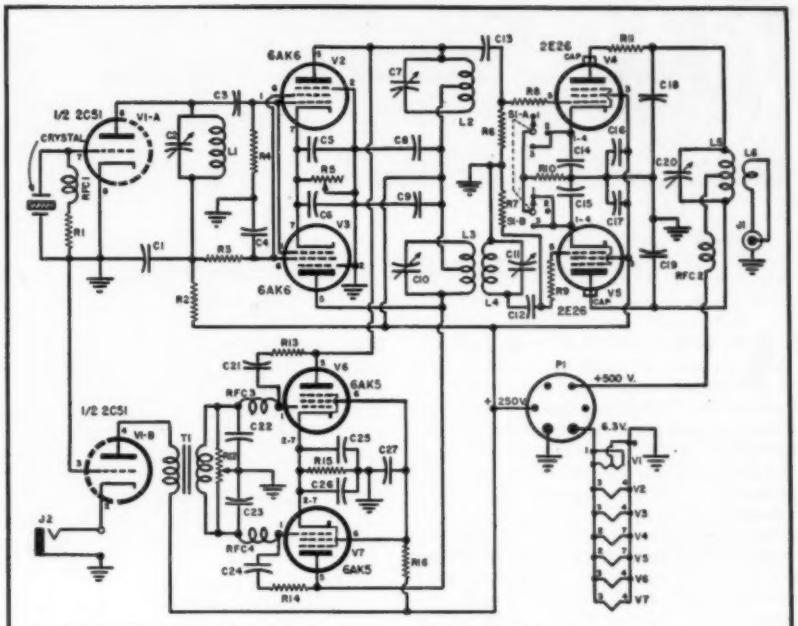
The outputs of both 2E26's are combined push-pull in a single tank circuit (L_5, C_{20}). Experiment indicates that parallel operation leads to difficulties in securing the proper phase relationship necessary for correct operation of this system. A tendency toward instability in the 2E26's was corrected with small carbon resistors in grid and plate leads. These resistors were installed only where required.

The only precaution that should be taken in the construction of this unit, and one that is not common to all exciters, is that reasonable care should be taken so that the outputs of the 6AK6's are not combined through stray coupling in the wiring. If these outputs are coupled in any way amplitude modulation of the drive to the 2E26's will result, causing distortion. The oscillator and the two 6AK6 tank coils were placed at right angles and all wiring associated with the 6AK6 plate and 2E26 grid circuits was separated as much as possible.

The coil forms and variable condensers in the unit pictured were salvaged from BC-610 tuning units, since they were well adapted to the purpose.

As an exciter for a pair of 813's it is necessary to tune the 2E26's separately and drive each 813 individually. The 813 outputs are then combined in push-pull. See Fig. 5.

This system of modulation is entirely flexible. It is possible to double in any stage without affecting the modulation (we tried it). It is also possible



R_1, R_4, R_{12}, R_{14}, R_{16}—47,000 ohm, ½ w. res.
R_2, R_3—5000 ohm, 1 w. res.
R_5—5000 ohm wirewound var. res.
R_6, R_7—10,000 ohm, 1 w. res.
R_8, R_9—68 ohm, ½ w. res.
R_{10}—200 ohm, 10 w. wirewound non-inductive res.
R_{11}—50 ohm, 5 w. wirewound res.
R_{13}—1 megohm pot.
R_{15}—130 ohm, ½ w. res.
C_1, C_4, C_6, C_9—.01 μfd., 600 v. cond.
C_2, C_7, C_{10}, C_{11}—100 μμfd. midget var. cond.
C_3, C_{12}, C_{13}, C_{21}, C_{24}—100 μμfd., 500 v. mica cond.
C_5, C_{22}, C_{25}, C_{26}—.001 μfd., 200 v. mica cond.
C_8, C_{23}—10 μfd., 50 v. elec. cond.
C_{14}, C_{15}, C_{16}, C_{17}, C_{27}—.1 μfd., 600 v. cond.
C_{18}, C_{19}—100 μμfd., 1000 v. mica cond.
C_{20}—100 μμfd. midget var. cond. (National ST 100)
J_1—Coax connector
J_2—Open circuit jack for carbon mike
P_1—6-prong plug
RFC_1, RFC_2, RFC_3, RFC_4—2.5 mh. r.f. choke
T_1—Audio trans. 3:1 ratio
Crystal—75 meter crystal
S_1—D.p. 3-pos. wafer sw.
L_1—33 t. #22 en., closewound on 1" form
L_2, L_3, L_5—33 t. #22 en., closewound on 1" form, center-tapped
L_4—40 t. #26 en., closewound on ¾" form wound on one end of 2½" form (slides into L_5 to adjust coupling for equal power from each 2E26. This adjustment required only during construction)
L_6—9 t. #22 d.c.c. wound over center of L_5
V_1—2C51 tube
V_2, V_3—6AK6 tube
V_4, V_5—2E26 tube
V_6, V_7—6AK5 tube

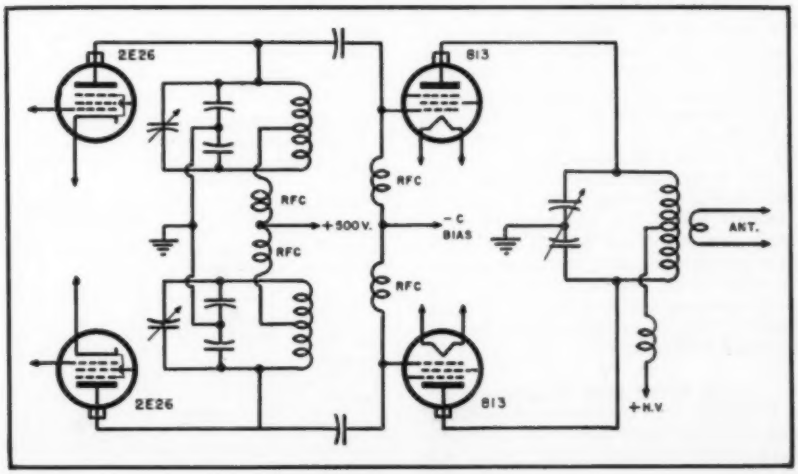
Fig. 4. Complete schematic diagram and parts list for the phone transmitter.

to feed the output of an e.c.o. into the crystal stage, but careful peaking of each stage is necessary if the frequency is moved more than a few kilocycles.

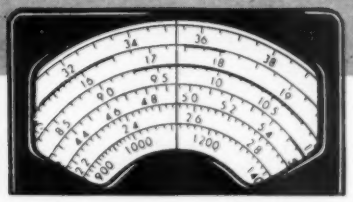
The tuning procedure is simplicity itself. First disconnect the microphone and connect a 25 watt lamp to the antenna connector, then throw the 2E26 cathode switch to position 1 and tune C_2, C_{10}, C_{11}, and C_{20} for peak output. A milliammeter in the 2E26 plate circuit would be dipped in the usual manner by C_{20}. Then throw the switch to position 2 and tune C_7 for peak output.

(*Continued on page* 76)

Fig. 5. How the unit described can be used as an exciter for a high power amplifier.



International SHORT-WAVE



***Compiled by* KENNETH R. BOORD**

AT THE time this was written, *Radio Peking* was presenting prisoner-of-war messages (voiced by United Nations soldiers captured in Korea) at approximately 0445 and 1715 over one or more of these channels—15.17, 15.060V, 11.685 (announced 11.690), 10.260, and 6.100. *(Anyone picking up such messages—where addresses of relatives are given—should forward them promptly. Most are of a propaganda nature and it is believed the POW's are "forced" to read them; but at least, it may let "homefolks" know that the serviceman is a POW, and not merely "missing." Also, please be on the lookout for POW messages from Communist outlets in addition to Radio Peking. Thanks!*—KRB)

The New Zealand Radio DX League has been doing some wonderful work in monitoring *Radio Peking* and then relaying POW messages. Towards the end of May, the League had already handled upwards of 1000 names. Arthur T. Cushen, an official of the League, writes me:

"The New Zealand Radio DX League, with members interested in short-wave radio reception, feels it can help the many friends of the United Nations by providing this service. These messages are compiled from the reports of many listeners. During World War II, the League handled some 6000 names, and in this present conflict has sent many hundreds of names forward to the representatives of the interested countries, located in the Dominion of New Zealand. In the case of 'personal' messages, these have been forwarded to the next of kin, where possible, and we know how much they are appreciated, as they often have been the first news about men missing for months. Many messages are being handled daily—many of them the first news since last October and November."

It is a pleasure to dedicate the *ISW DEPARTMENT* this month to the New Zealand Radio DX League, its members, and all other SWL's the world over who are doing such splendid work in monitoring POW broadcasts and then relaying the messages to "homefolks!" This is a commendable service to their fellowmen!

* * *

Visit With ISW Monitors

Recently, on a trip to the West Coast and through the South, your *ISW DEPARTMENT* editor made many fine contacts with both veteran and newer monitors—including Paul Dilg, August Balbi, Frank Winch, Carl B. Rosenauer, J. Art Russell, Harold Stein, California; Jack Slattery, John Callarman, Oregon; Ramon Stark, Texas; Bill Fargo, Georgia; Grady C. Ferguson, North Carolina, and others. Sorry time would not permit contacts with even more!—KRB.

* * *

Club Notes

Sweden—Bertil Thorner has given up his duties as editor of *GDX-aren*, house organ of the Goteborgs DX-Klubb, and the new editor is Harry Ericsson, Volrat Thamsgatan 5a, Goteborg, Sweden. Thorner will remain as secretary of the group.

USA—The Newark News Radio Club held its annual convention-outing at Mapine Farm, Moyers Road, Lansdale, Pennsylvania, Sunday, June 24. Hosts were Harold Robinson, one of NNRC's vice-presidents, and Mrs. Robinson. The club recently chose these officers for the coming year—Irving R. Potts, president; Walter L. Townley, treasurer; Albert J. Sauerbier, executive secretary; Benjamin Feinstein, assistant executive secretary; Peter J. McKenna, Lester W. Kraemer, Henry T. Tyndall, John W. Reichert, Charles S. Sutton, Abe Cohen, Louis Hahn, Charles P. Atherton, Harold Robinson, Roger Legge, Le Roy Waite, Jack D. Rhea, vice-presidents; and G. Dudley Clarke, Canadian vice-president. The editorial staff includes Mr. Potts, editor; Carroll H. Weyrich, Frank Pytlak, Charles R. Conley, broadcast band; Henry and Amelia Bennett, short-wave; Sheldon Dunham, Stephen A. Mann, amateur; and Carleton Lord, special features.

* * *

This Month's Schedules

Andorra—Radio Andorra noted in Scotland on 5.995 at 1600-1630. (Rodger)

Angola—Radio Clube de Benguela, CR6RB, noted on 9.165 at 1345 and to sign-off 1401 with "A Portuguesa"; bad CWQRM. (Pearce, England)

Argentina—SIRA, Buenos Aires, is now using 17.72 with *English* around 1400-1630; call is LRA. (Serrano, Brazil) This one noted in Delaware with talk in *English* 1300-1318. (Cox) Heard on this channel with news in Spanish 1043. (Dyrektor, Brazil)

Australia—Radio Australia now is using new suffixes—the numeral following the transmitter call-sign now indicates the megacycles band in use; the same suffix is used for any frequency in a particular band; examples, VLA15 any frequency in the 15-mc. band; VLA9 any frequency in the 9-mc. band; VLB21 any frequency in the 21-mc. band, and so on. Recent alternations to schedules include 0328-0450, VLB11, 11.85, to Forces in Japan; 0328-0645, VLC15, 15.320, to S. and S.E. Asia; 0328-0855, VLA9, 9.580, to Forces in Japan; 0359-0700, VLG11, 11.880, to China and N. Pacific; 0500-0945, VLB11, 11.850, to S. and S.E. Asia; 0700-1115, VLC11, 11.810, to North America; 0715-0830 (to 0900 Sats.), VLG9, 9.540, to S.E. Asia; 0900-1115, VLA9, 9.580, to S. Asia and Middle East; 1000-1115, VLB9, 9.560, to Africa. (Radio Australia via Stark, Texas)

Belgian Congo—After trying various channels—including (announced) 9.745 and 9.800—at the time this was written, OTC2, Leopoldville, was back on its usual 9.767 spot with the usual interference! (Kinge, N.Y., others) Catch, England, says lately he has noted OTH, Leopoldville, rather consistently on (measured) 9.216, good level around 1300; old schedule was 1230-1330 but now is heard as late as 1400 some days.

OTM2, 9.400, Leopoldville, noted with strong level from 0000 sign-on; news in French at start. (Cox, Dela.) After 18 months, a card has been received from OQ2AC, *Radio College;* QRA is College St. Francois de Sales. Elizabeth, Congo Belge; frequencies are 7.200, 4.980, 3.390, all 250 watts, scheduled 0200-0400, 1130-1230. (Hannaford, Sou. Afr.)

Bolivia—Serrano, Brazil, reports as a *new* station, Potosi, approximately 6.265, heard from around 1900 to *after* 2145 in Spanish.

Brazil—Radio Nacional, Rio de Janeiro, has a *new* schedule of 0400-1200, 9.72; 1200-1515, 6.147; 1515-1700, 9.72; 1700-2305, 6.147; asks for reports especially on last period of broadcast. The "*Agencia Nacional*" news program is

(*Continued on page* 108)

(Note: Unless otherwise indicated, all time is expressed in American EST: add 5 hours for GCT. "News" refers to newscasts in the English language. In order to avoid confusion, the 24 hour clock has been used in designating the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200 while from 1 p.m. to midnight are shown as 1300 to 2400.) The symbol "V" following a listed frequency indicates "varying." The station may operate either above or below the frequency given. "A" means frequency is approximate.

The PULSE-FORMER

By
LOUIS E. GARNER, JR.

Fig. 1. Over-all view of the "Pulse-Former."

Basically—a simple series-diode clipper is used to form narrow pulses from an applied sine wave.

A UNIQUE one-tube device that will form narrow pulses from an applied sine-wave is shown in Fig. 1. Its small size (4"x5"x6") is apparent from the photograph and, as the size implies, its circuit is quite simple, only one control ("Pulse Width") being required.

To obtain pulses, an unsymmetrical series-diode clipper is employed. The series-diode clipper has been previously described as a generator of square waves.[1] To understand the operation of the circuit as a device for forming pulses, it is first necessary to review the theory of operation of the series-diode clipper in its basic form, as shown in Fig. 2.

Diode halves D_1 and D_2 are normally conducting due to the bias voltage supplied by battery E. Note that the polarity is such that the cathodes of the tube are maintained negative with respect to their plates. R_2 serves as a current limiting resistor and R_1 and R_3, generally equal in value, serve as the input and output loads. The circuit is perfectly symmetrical in that either side (R_1 or R_3) may serve as the input while the other serves as the output.

As long as the diodes are conducting, they act as a closed circuit, permitting any applied signal to appear across the output load. Should the peak voltage signal exceed the battery voltage, one or the other diode will stop conducting and act as an open circuit, thus "clipping" the remainder of the signal. Diode D_1 opens on negative peaks, while diode D_2 opens on positive peaks.

When used as a square-wave generator, the applied peak signal voltage is kept many times higher than the battery voltage so that the clipped signal forms an almost perfect square wave (with a sine wave applied) with a comparatively short rise time, sharp corners, and a flat top.

In the original model, R_1 and R_3 were given a value of 18,000 ohms, while R_2 was 2200 ohms. The circuit worked quite well with a small audio oscillator having a low impedance output. When later tried with a signal source having a medium impedance output, it was found that the resulting "square wave" was unsymmetrical and generally unsatisfactory for conventional square-wave testing.

This unsatisfactory operation was found to be due to the unequal loading existing on positive and negative halves of the applied signal. With D_1 conducting, R_1 and R_3 are essentially in parallel, while on negative peaks, the load on the signal source is represented by R_1 alone. New values for R_1, R_2, and R_3 were suggested to minimize this loading effect.[2] The new values suggested were 4700 ohms for R_1 and R_3, and 22,000 ohms for R_2.

With these values, satisfactory operation of the circuit as a square-wave clipper could be obtained even with comparatively high impedance sine-wave signal sources.

The author decided to carry out additional experimentation with the basic circuit to see if "unsymmetrical clipping" could be put to some useful purpose. Experiments led to the final design of the circuit shown in Fig. 4A. This circuit, when used with a medium impedance sine-wave source having reasonably high amplitude, will supply positive-going pulses, with short rise time, flat tops and "bottoms," and with a variable pulse width (desirable for some types of development work).

To understand the formation of the pulse from a sine wave, refer to Fig. 3. In 3A is shown a "clipped" sine wave, with clipping symmetrical about the zero axis. Note that the tendency is towards the formation of a perfect square wave.

Suppose, now, that the axis is displaced upward, with clipping still symmetrical on either side, as shown in C-D of Fig. 3B. Under such conditions, one "half" of the signal is narrower than the other "half" and a rectangular, rather than a square wave, is formed.

The action of the unsymmetrical clipper is not quite as simple as described, of course, but this serves as a rough approximation of the results obtained with unequal loading on positive and negative halves of the signal. An idea of the degree of change in

Fig. 2

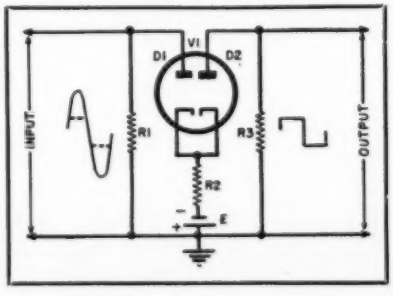
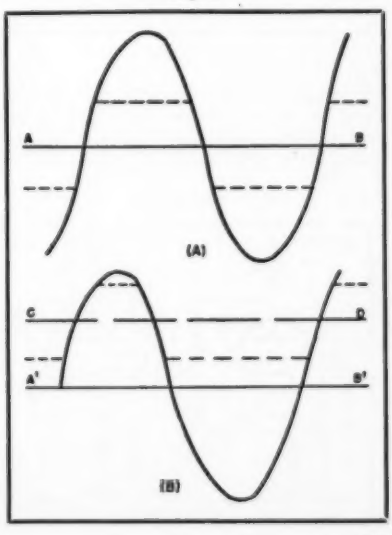
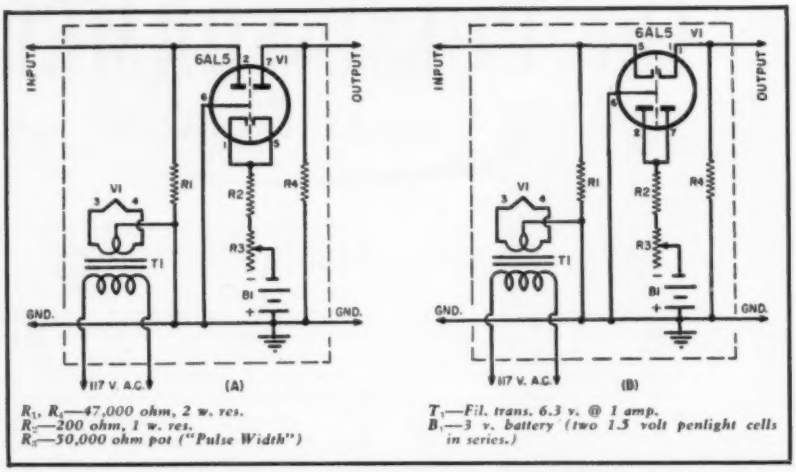


Fig. 3



[1] Garner, Louis E., Jr., "Wide Frequency Range Square-Wave Clipper, Radio & Television News, March, 1950.
[2] Garner, Louis E., Jr., "Additional Notes on Square-Wave Clipper," Radio & Television News, July, 1950.



R_1, R_4—47,000 ohm, 2 w. res.
R_2—200 ohm, 1 w. res.
R_3—50,000 ohm pot ("Pulse Width")

T_1—Fil. trans. 6.3 v. @ 1 amp.
B_1—3 v. battery (two 1.5 volt penlight cells in series.)

Fig. 4. Diagram of "Pulse-Former." (A) Positive-going pulses, and (B) negative-going pulses.

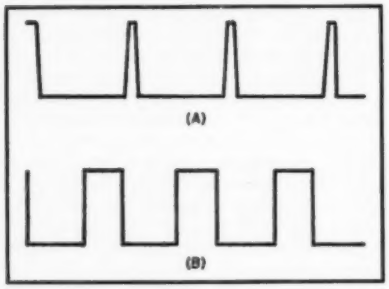


Fig. 5.

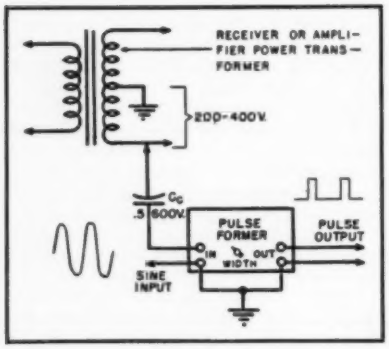


Fig. 6.

loading may be obtained by comparing the sizes of R_1 and R_3, Fig. 4A (assuming R_3 adjusted so that it is not in the circuit). R_1 has a value of 47,000 ohms, while R_3 has a value of only 200 ohms. Thus, with the first diode conducting, the input impedance is slightly less than 200 ohms (R_1 and R_3 in parallel). On negative half-cycles, the input impedance is again almost 50,000 ohms. With a medium to high impedance signal source, the amplitude of the positive halves of the signal drops considerably when compared to the negative half-cycles. This results in the circuit "clipping" only the extreme peaks of the positive half-cycles, with the output assuming a pulsed form.

By varying the size of R_2 by means of R_{2a}, in series with it, the degree of unequal loading may be changed, and hence the pulse width varied. Thus R_2 acts as a *pulse-width* control.

With the values shown in the parts list, the pulse width of a 60 cps signal may be varied from the minimum shown in Fig. 5A to the maximum shown in Fig. 5B. The pulses are actually as sharp and square as shown.

The circuit shown in Fig. 4A delivers positive-going pulses, since it is the positive "half" of the applied signal that is loaded. To obtain negative-going pulses, it is only necessary to reverse the plate, cathode, and battery connections of the clipper, giving the circuit shown in Fig. 4B.

If the device is constructed in a standard 4"x5"x6" metal utility box, like the author's (Fig. 1), it is not necessary to make a sub-chassis. The one tube socket used may be mounted on long machine screws with spacers to prevent the pin lugs from shorting to ground. The small filament transformer is simply bolted to the side of the metal box, while the two small penlight cells (connected in series to provide 3 volts) are clamped or strapped to the back panel.

All wiring is point-to-point, with the input and output resistors (R_1 and R_4) mounted directly between the binding posts.

If preferred, the filament transformer may be eliminated, with filament voltage for the 6AL5 being supplied by the power supply of the circuit or device with which the "Pulse-Former" is used.

If a fixed pulse-width is desired, R_3 may be eliminated, and R_2 replaced with a fixed resistor having a value to give the desired pulse width. Determine the proper size resistor to use experimentally by observing the output on a scope and varying R_2 until the desired pulse is obtained.

Once construction is finished, the "Input" terminals of the "Pulse-Former" are connected to an appropriate sine-wave signal source. The higher the voltage available, the better the pulse formation. For 60 cycle pulses, an ordinary power transformer may be used, as shown in Fig. 6. Condenser C_c serves to block d.c. (assuming the power transformer to be in a power supply circuit) and also to convert the source into a comparatively high impedance source.

If pulses at some other frequency are desired, use an audio oscillator having a medium to high impedance output, with a peak voltage of at least 100. If sufficient voltage is not available, use a conventional audio amplifier, with a step-up transformer on the output. A coupling condenser must still be used to avoid shorting the battery B_1 (Fig. 4A) with the transformer winding. Determine the correct condenser size by experiment.

An oscilloscope can be connected to the "Output" terminals, and the "Pulse-Width" control adjusted until pulses of the proper form are obtained. The pulse output is then connected to any circuit desired.

If there is a possibility of a d.c. short to ground existing in the circuit to which the pulse output is connected (transformer primary, for example), or if there is a d.c. voltage present, use a coupling condenser between the output "hot" terminal and the circuit for blocking purposes. A .5 μfd., 600 volt condenser will be satisfactory for most applications, but a larger condenser may be required if the circuit has a comparatively low impedance input.

The experimenter, technician, and engineer will undoubtedly have many uses in mind to which sharp pulses might be put. It would be worthwhile, however, to list a few of the more common applications.

A positive-going pulse may be used in connection with a triode tube and condenser to form almost perfectly linear saw-tooth signals as shown in Fig. 7A. Condenser $C_{dis.}$ charges slowly through R_p while V_1 is biased to cutoff by $C-$. When the positive pulse arrives, tube V_1 conducts during the period of the pulse, rapidly discharging

Fig. 7.

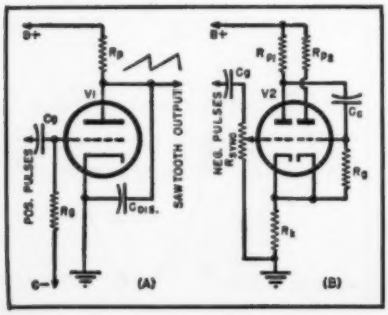


Fig. 8.

$C_{dis.}$ and forming the retrace of the saw-tooth signal. The retrace time may be varied by changing the pulse-width. R_p and $C_{dis.}$ may be chosen experimentally to give the best saw-tooth at the pulse rate used.

With a circuit like that in Fig. 7A, the saw-tooth frequency depends solely upon the pulse rate, and hence a stable linear sweep may be obtained (depending, of course, upon the stability of the pulse source).

Conventional sweep circuits used in cathode-ray oscilloscopes, multivibrators and relaxation oscillators, blocking oscillators, and similar circuits sync much better with pulse signals than with sine waves or complex signals. Hence, pulses are often used for syncing such circuits.

As an example, the Potter multivibrator shown in Fig. 7B syncs best when negative-going pulses are applied to its grid. Negative pulses may be obtained with the circuit shown in Fig. 4B.

The amplitude of the pulses obtained with the "Pulse-Former" depends upon the size of the battery. If this is increased to higher voltages, then the pulse height increases, but correspondingly higher drive voltages are required for good pulse formation.

Even the approximately three volts peak pulse obtained with the circuit as given in Figs. 4A and 4B is sufficient for "intensity" modulation of some scopes. When used in such an application, the pulses from the "Pulse-Former" may be used for blanking retrace or for comparing frequencies.

When the output is connected to the "Intensity Modulation" terminals of the scope, the beam may either be made brighter or darker on pulses, depending on the internal connections in the scope itself. As an example, if positive-going pulses are used and the "Intensity" connections are to the cathode of the CRT, then the beam will be made darker on pulses and may even be blanked out entirely (depending on the setting of the "Intensity" control on the scope).

If a sine wave is observed on the scope with a frequency much lower than the pulse rate, it will be broken into a series of dashed lines as shown in Fig. 8A.

On the other hand, if the internal connections of the scope are to the grid, the beam will be made brighter on pulses, and a similar signal may appear as a series of dots or very short dashes as in Fig. 8B.

For frequency comparison, it is only necessary to count the number of complete cycles between pulses on the CRT screen. As an example, if there are three complete cycles of an observed signal on the screen of the scope between the short dashes representing the pulses, the frequency of the observed signal is three times that of the pulse rate.

As the experimenter begins to work with pulses, he will discover more and more uses to which they may be put.

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Mac's RADIO SERVICE SHOP

By JOHN T. FRYE

SERVICING THE HARD WAY

GLANCING up from the variable inductance TV tuner on which he was working, Mac saw his assistant, Barney, rummaging around in the wall cabinet that housed the shop's collection of cleaners, solvents, varnishes, stains, lubricants, etc., and said, "Hey, Red, while you're up there in the bottle goods department, how's about handing me down that bottle of *Stanoil* #15 Lubricant for this tuner?"

"Here you are, Boss," Barney replied, "but I sure would like to know what the heck happened to that bottle of carbon tet I know I saw up here this morning."

"That's easy," Mac observed blandly as he went on squirting carbon tetrachloride from the pressure-type oil can in his hand over the inductances of the tuner so as to wash away completely the old lubricant and the dirt imbedded in it; "it's sitting right here on the bench in front of me."

"Looks like you'd tell a man," Barney growled as he pulled a piece of cleaning tissue from a wall dispenser and saturated it with the cleaning fluid.

"What are you going to do with it?" Mac wanted to know.

"Wipe some grease smudges off this white plastic cabinet. Why?"

"First, try a little spot on the inside of the cabinet that will be covered by the chassis."

Barney obediently moistened a small spot on the bottom of the cabinet, and some of the cleansing tissue stuck to it.

"Well whadda you know!" he said in amazement; "carbon tet cuts that finish! I never noticed that happening before, and I have cleaned dozens of cabinets with the stuff."

"Yes, I know," Mac replied; "and it will not hurt many of the older cabinets; but I learned the hard way that you had better not use carbon tetrachloride on many of the cabinets coming out lately without doing a little testing first. The best idea is just to stick to good old soap and water and elbow grease. It takes a little more time and effort, but it's safe."

"Sure is funny how many times the *best* way seems to turn out to be the *hardest* way," Barney grumbled as he went to work with the soap and water. A few minutes later he had finished with the little white radio and had put a storage battery portable on the bench. When he turned it on, a loud hum came from the speaker along with the program. The hum was present even when the a.c. cord was not plugged in.

"Okay, Brains," he said to Mac who had completed cleaning and lubricating the tuner and was now replacing it in the chassis, "what's the matter with this one? Does your educated ear say that it is filter condensers, or is the battery no good? I don't want to take that front cover off unless I have to."

"I'm glad you know that a weak battery will cause a loud hum in one of these jobs—especially when the set is working on a.c.," Mac said approvingly; "but if I remember rightly, you put a new battery in that set not over a couple of months ago. Try wiggling the battery around a little."

Barney slipped off the cover of the power supply compartment and moved the battery around. Immediately the humming stopped.

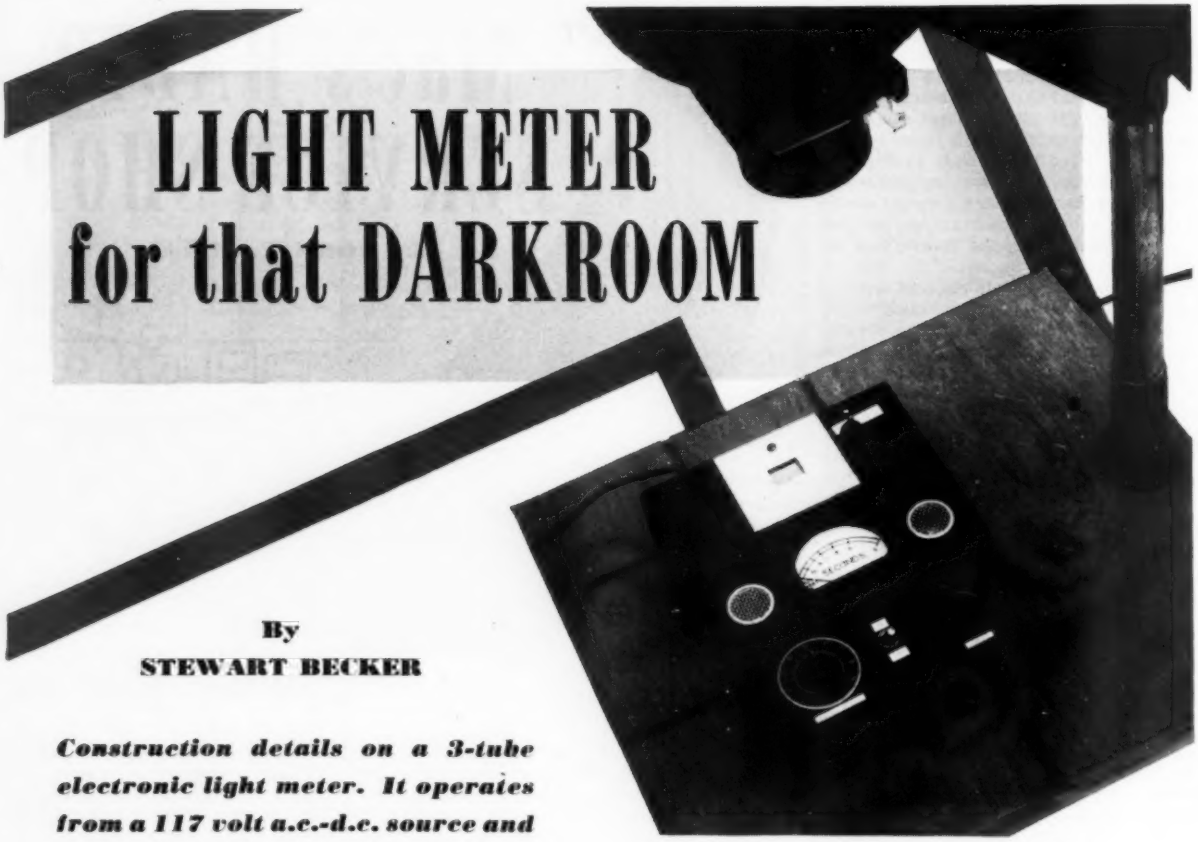
"Wipe that smug look off your face

(*Continued on page* 116)

LIGHT METER for that DARKROOM

By
STEWART BECKER

Construction details on a 3-tube electronic light meter. It operates from a 117 volt a.c.-d.c. source and is calibrated in seconds-exposure.



The meter, positioned as shown, will indicate intensity of the light that would actually fall on the sensitized paper, eliminating exposure errors.

THE light meter to be described was designed and built for use in the amateur photographic darkroom to eliminate test exposures when making enlargements. Just as your exposure meter out of doors collects light from a representative part of the scene you are about to photograph, so this light meter collects light from a representative part of the image on the enlarging easel. Making this measurement right at the sensitized paper rather than at the negative eliminates any calculations involving lens aperture and number of times enlargement. Just focus up the enlarger as you always do, set the light meter on the easel so that a representative part of the picture falls on the window over the phototube, open the window and read the number of seconds exposure directly on the meter. It's that simple and the results will run about the same percentage correct as they do when using an exposure meter out of doors.

The unit is constructed in a flat plywood box with a metal panel. It measures 2½ inches deep by 7¼ inches by 8½ inches. It will operate from a 117 volt a.c. or d.c. circuit. The light meter is essentially a bridge circuit with a 100 microampere d.c. meter as an indicator of balance. Light falling on the phototube unbalances the bridge, causing the meter to read. R_1 controls the amount of voltage applied to the anode of the phototube thus acting as a sensitivity control for papers of various speeds. R_6 is a zero adjustment for balancing the bridge for zero reading when the phototube is dark.

A single vacuum tube Type 117N7-GT consisting of a beam power pentode and a diode, in conjunction with a voltage regulator tube and a phototube, are the only vacuum tubes required. The 117N7 was used because its filament can be connected directly across the 117 volt power line thus eliminating the necessity of a filament transformer. Since the plate resistance of the 117N7 in this circuit is about 9000 ohms, the zero adjustment should balance at about the middle of its range. The two 1000 ohm resistors in series with the 3000 ohm zero adjustment potentiometer are for the purpose of preventing the zero adjustment from being too critical. If you don't mind this adjustment being a bit critical, they can be omitted. If you want the adjustment to be less critical, increase the value of these two resistors.

The diode of the 117N7 is used as a half-wave rectifier to supply d.c. voltage for the operation of the pentode and the phototube. The voltage from this diode is stabilized at 90 volts d.c. by a VR-90 voltage regulator tube. This voltage regulator is absolutely essential unless you have unusually stable line voltage. It prevents line voltage fluctuations from causing the meter reading to vary up and down with these fluctuations. If you have some rapid kicks in your line voltage which this tube will not handle, try putting a condenser across the 10 megohm grid leak (R_2) to increase the time constant of this circuit. A .1 μfd. at this point will give this circuit a time constant of one second and this should stabilize the meter against these kicks. If you think the meter is too sluggish with this value of condenser, reduce it to a .05 μfd. or a .01 μfd. or to a value which gives you the best operation for your line voltage conditions and your temperament.

If you want more sensitivity than the circuit as shown provides, just increase the resistance of the grid leak but don't get it too high or you will find that your light meter works fine on dry days but is off calibration on humid days. Ten megohms should be a good all-around value, or even twenty megohms. Values up to 700 megohms have been used with satisfactory results here in Arizona, but this would not be the case in most locations.

When using this light meter, never open its window when the white light is turned on in the darkroom or the meter may be damaged. Its sensitivity is many times that of a conventional exposure meter and this must be kept in mind when using it. It is best to

shade the window from the direct rays of the safe light as erroneous readings might be caused by this light. Use an internally illuminated microammeter if possible so the exposure can be read accurately in the subdued lighting of the dark room. You will find that rather dim internal illumination of this meter is all that is required. If you can't get a microammeter with internal illumination, mount a small flashlight bulb on the outside so as to illuminate the meter scale. Be sure this light does not get into the window of the phototube and that it does not fog your enlarging paper.

Be careful to make the whole unit lightproof, or at least the part containing the phototube. If you use small screened openings to let the heat out as on the unit shown, an internal baffle will be necessary to prevent light which may enter these from falling on the phototube. "Lightproofness" is especially important around the sliding window over the phototube. Incidentally, if you don't have materials on hand for making a sliding window as shown, all you need is a little block of wood with felt on the bottom with a smaller block fastened to the felt which just fits into the phototube window. The smaller block will hold this blind in place so it won't fall off when moving the light meter around and the felt makes it lightproof. This arrangement is just as satisfactory as the one shown and, in fact, was used on the first model of this light meter.

The model shown is calibrated directly in seconds exposure but it would be advisable to use your light meter for a while with just the 0-100 scale provided on your meter until you become familiar with its operation. Then it will be a very simple matter to calibrate it directly in seconds any time you want to. To do this, focus up an average negative at from 2 to 3 times enlargement and with the meter set to zero with the phototube dark, and the paper speed dial set on 100, set the light meter on the enlarging easel with a representative part of the image falling on the window. Open the window and adjust the iris diaphragm in your enlarger so that the meter reads exactly 100. Now remove the light meter and determine by trial and error just what exposure will give you the best enlargement using the most sensitive enlarging paper you normally have on hand, for example *Kodabromide*. This exposure will be the proper time to mark at the top of your scale. This is the only point which has to be calibrated. A negative which gives a reading on the meter of half-scale will require just twice the exposure. A negative which gives a reading on the meter of one-quarter scale will require an exposure of four times the full scale reading. Thus the exposure is doubled every time a scale reading is halved. The setting of the paper speed dial for other papers can be found by trial and error.

As for mechanical details, many arrangements are possible. In the unit shown, all of the parts are mounted on a chassis which fastens to the meter studs. A shelf across the panel side of this carries the two tubes, and a small bracket mounted directly on the panel carries the phototube. This puts the base of the phototube right near the base of the 117N7 thus making for short leads. The 500 ohm, 5 watt resistor and the 4 μfd., 150 volt electrolytic condenser can be seen next to each other in the photo showing the inside of the unit. Next come the two 1000 ohm resistors and then the 25 μfd. low voltage electrolytic under the meter. The 2000 ohm *Koolohm*, directly below the meter but not included in the schematic diagram, is a series resistor for lighting the meter illuminating lamp directly from the 117 volt line. Next can be seen the 10 megohm grid resistor shunted by a condenser which is not shown on the schematic but which has already been discussed.

Make the whole unit as thin as possible so that the panel will not be too far above the sensitized paper. If it is too thick, the image from the enlarger will be too much out of focus and it will be difficult to tell just what part of the picture is falling on the phototube window. A good arrangement would be to put the phototube in a little box all by itself and then connect this to the other unit by a two-conductor shielded cable. Then the meter unit could be permanently installed and the small probe unit containing the phototube could be stored away or hung on a nail when not in use. The probe unit would have to be only about as thick as the diameter of the phototube. The window size should match the size of the cathode of the phototube which in the case of the 5582 phototube is ⅝ inch by 1 inch.

Almost any photocell is suitable. The 5582 was used because it was on hand. Gas filled phototubes are considerably more sensitive than high vacuum types but they are not as stable or as linear. The spectral characteristics of the cathode are not very important for this application because it is always used under the same color conditions, except that a phototube sensitive only to infrared would not do! While on the subject of spectral characteristics, it should be pointed out that it is not advisable to vary the illumination in the enlarger by varying the voltage on the enlarger bulb as is often done when not using a light meter. This method varies the color of the lamp filament and since the spectral response of the phototube is not constant over the visible spectrum, erroneous results as to exposure will be obtained. Varying the light intensity with an iris diaphragm does not introduce this difficulty.

Paint the inside of the box and all mounting brackets, chassis, etc. black to keep any light which may leak in or which may come from the tube filament or the voltage regulator tube from being reflected around and eventually reaching the phototube. Paint the outside of the panel black too and then paint a section approximately three inches square around the window with aluminum paint or flat white paint so that this part of the picture can be seen clearly.

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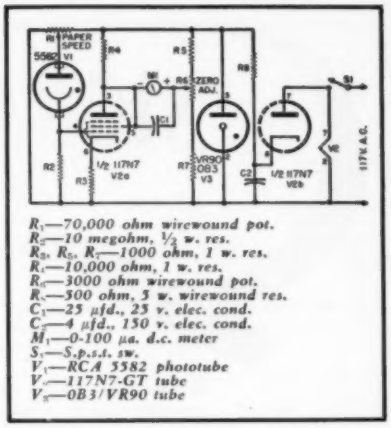
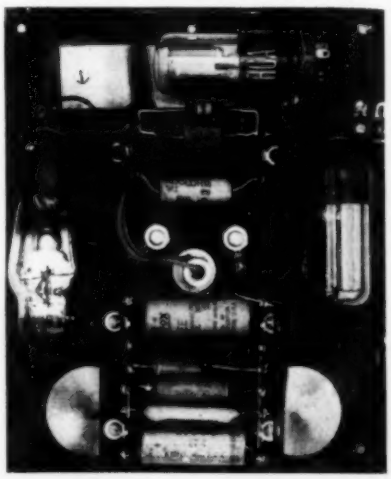


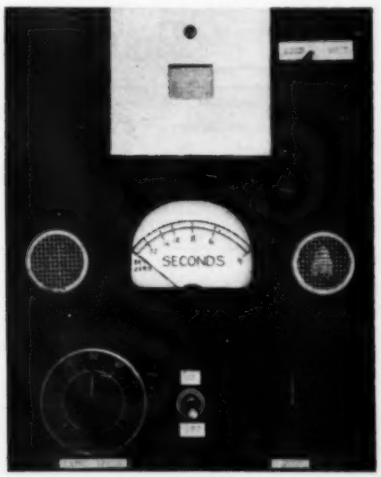
R_1—70,000 ohm wirewound pot.
R_2—10 megohm, ½ w. res.
R_3, R_5, R_7—1000 ohm, 1 w. res.
R_4—10,000 ohm, 1 w. res.
R_6—3000 ohm wirewound pot.
R_8—500 ohm, 5 w. wirewound res.
C_1—25 μfd., 25 v. elec. cond.
C_2—4 μfd., 150 v. elec. cond.
M_1—0-100 μa. d.c. meter
S_1—S.p.s.s. sw.
V_1—RCA 5582 phototube
V_2—117N7-GT tube
V_3—0B3/VR90 tube

Complete wiring diagram of electronic light meter. It is easy to calibrate.

Rear view of panel. The RCA-5582 phototube is shown mounted horizontally at top.



Front panel view. The 0-100 microampere meter is calibrated in seconds-exposure.



SIGNAL SUBSTITUTION In TV Servicing

Once set up, test signals from a spare receiver serve as a quick and accurate means of servicing troublesome TV sets.

By
DANIEL LERNER
Supervisor of TV Service
Philco Corporation

MANY times the technician is puzzled by a particularly difficult television receiver trouble. He often suspects an individual stage, for in one way or another he is able to go through a troubleshooting procedure which will isolate the suspected stage. This procedure of trouble isolation can, in many instances, be accomplished quite easily, but in other cases this procedure may prove extremely difficult. Why not a simple system of signal substitution, so that a signal of the correct type can be furnished in place of one which is doubtful? While this article deals primarily with synchronizing and deflection signal substitution, audio and video signals can also be injected by substitution.

A bench setup where the receiver is wired to furnish the test signals is shown in Fig. 1. The various signals are wired from the receiver as shown in Fig. 3, and connected to their respective jacks.

J_1 provides a composite video signal for testing a complete video amplifier. An average value of 2 volts peak-to-peak for most TV receivers, as measured at the video detector load, should be available at this point. The amplitude of the signal may be checked with a calibrated oscilloscope. Perhaps before any more of the connections and functions are explained, it would be well to discuss oscilloscope calibration, since it is necessary to check the signal levels at the jacks.

Calibrating an Oscilloscope

The vertical gain control of a service oscilloscope may be calibrated so that the instrument can be used to measure peak-to-peak voltages. A simple way to make this calibration is by determining the vertical gain control settings, for a specific amount of deflection, when measured values of r.m.s. voltages corresponding to the desired peak-to-peak values are applied to the vertical deflection plates of the oscilloscope.

The scale of the vertical gain control should be calibrated for 100 volts, 50 volts, 25 volts, 10 volts, 5 volts, and 2 volts, peak-to-peak. Since an ordinary a.c. voltmeter reads r.m.s. voltage, it is first necessary to determine what voltmeter readings are equivalent to these peak-to-peak voltages. This is accomplished by dividing the peak-to-peak voltages by 2.828. Peak-to-peak and equivalent r.m.s. values are:

PEAK-TO-PEAK VOLTS	R.M.S. VOLTS
100	35.4
50	17.7
25	8.8
10	3.5
5	1.8
2	.7

To calibrate the oscilloscope, follow this procedure:

1. Connect an a.c. voltmeter, a 20,000 ohm, voltage dividing potentiometer, a transformer, and the oscilloscope as shown in Fig. 2A. The transformer is used for isolation purposes and may be a 1:1 audio interstage transformer or equivalent. Do not use horizontal sweep on the oscilloscope.

2. Adjust the potentiometer for a reading of 35.4 volts on the meter (35.4 volts r.m.s. equals 100 volts peak-to-peak).

3. Adjust the vertical-gain control of the oscilloscope to obtain a 1" (one-inch) deflection.

4. Using a wax crayon, make two horizontal lines across the scope tube, as shown in Fig. 2B, placing the lines across the top and the bottom of the 1" vertical indication on the screen. These two lines will be used to indicate full-scale readings of peak-to-peak voltages. Next, mark off the short horizontal lines as shown, dividing the 1" space into 10 divisions. These lines will be used for reading intermediate voltages. Cover the face of the tube with a layer of cellulose tape, to prevent smudging of the lines.

5. The voltage which was applied to the scope in steps 2 and 3 establishes the vertical gain control setting for a full-scale reading of 100 volts, peak-to-peak. Scratch a line at the vertical gain pointer setting, and label this line "100 v."

6. Adjust the potentiometer until the meter reads 17.7 volts, adjust the vertical gain control for the 1" deflection, and mark the point indicated by the pointer of the vertical gain control. Label this point "50 v."

7. Repeat step 6, using meter readings of 8.8, 3.5, 1.8, and .7 volts. In each case, mark the point of the vertical gain control setting, and label these points "25 v.," "10 v.," "5 v.," and "2 v.," respectively.

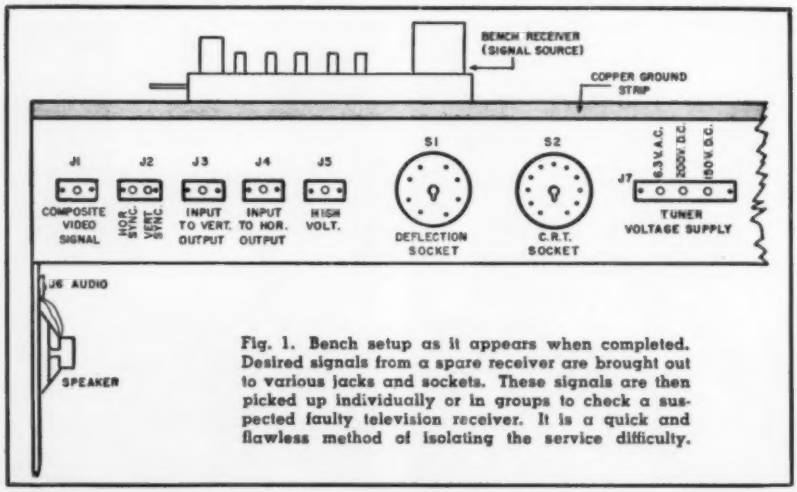


Fig. 1. Bench setup as it appears when completed. Desired signals from a spare receiver are brought out to various jacks and sockets. These signals are then picked up individually or in groups to check a suspected faulty television receiver. It is a quick and flawless method of isolating the service difficulty.

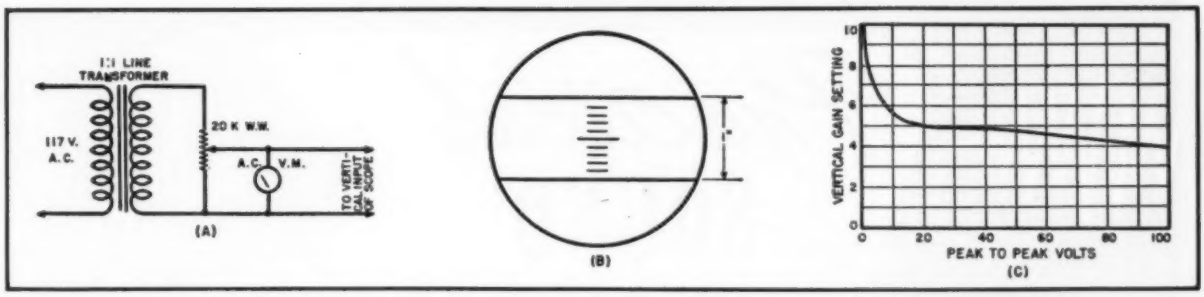


Fig. 2. (A) Wiring diagram of setup used to calibrate oscilloscope vertical gain control. (B) Oscilloscope tube marking for peak-to-peak voltage measurement. (C) Graph showing oscilloscope vertical gain control calibration.

After the outlined steps have been completed peak-to-peak voltages can be read directly from the oscilloscope screen. The voltage is directly proportional to height of the vertical deflection. For example, assume that the gain control is set for 100 volts, and that the voltage being measured gives a deflection covering 8 of the spaces between the full-scale limit lines. The amount of deflection is then 8/10 of the full-scale value. Therefore, the peak-to-peak voltage is 8/10 of 100 volts, or 80 volts.

If desired, a graph may be drawn for the particular scope being calibrated. Fig. 2C illustrates a typical curve, showing peak-to-peak voltages plotted against vertical gain control settings.

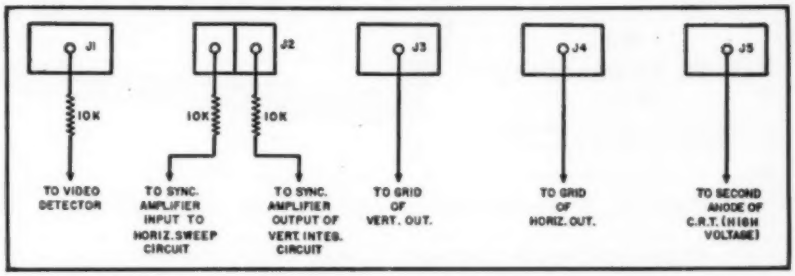


Fig. 3. Method for connecting jacks to sync and deflection circuits of TV receiver.

J_2 in Fig. 3 is the jack where the vertical and horizontal sync signals from the receiver are connected. The verti-

(*Continued on page* 114)

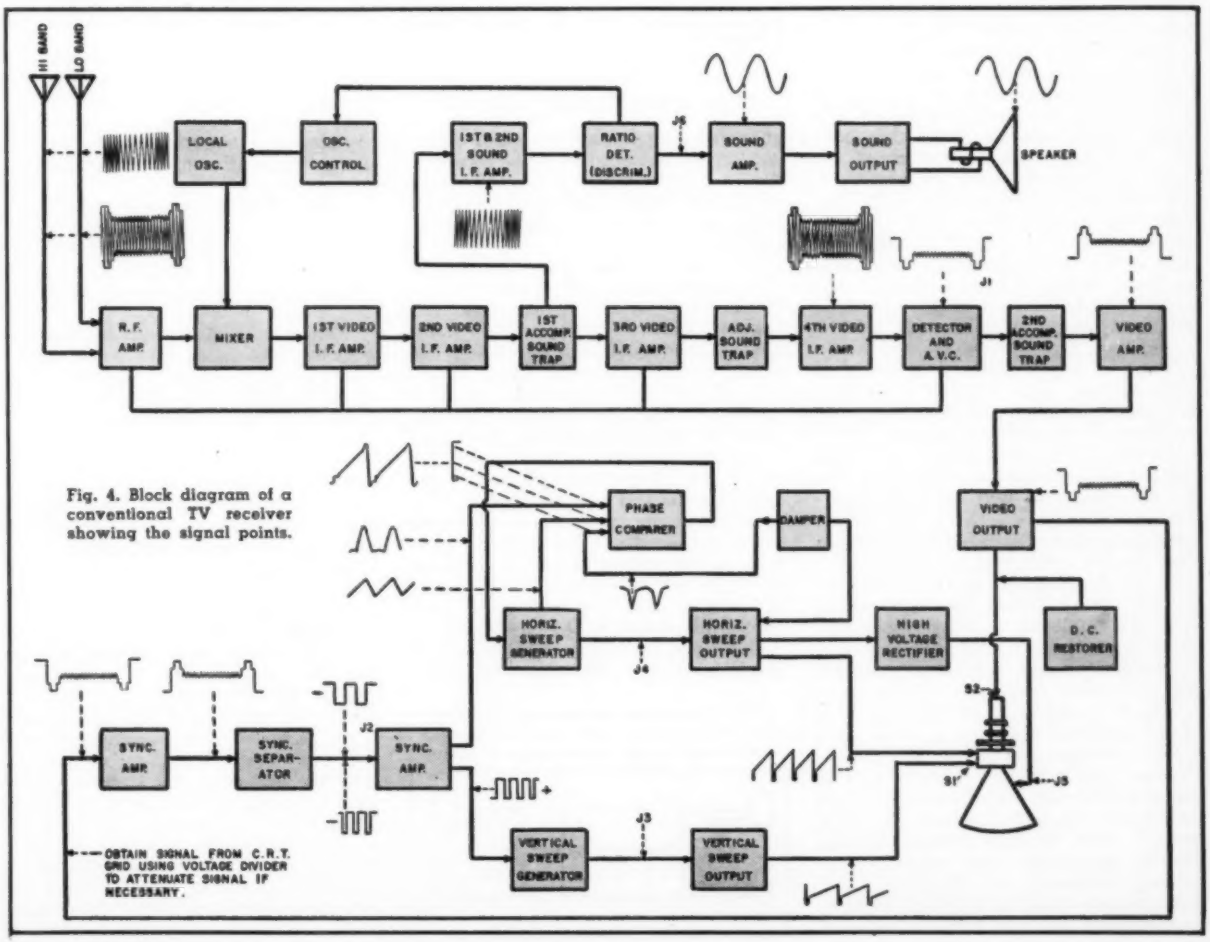


Fig. 4. Block diagram of a conventional TV receiver showing the signal points.

Practical SOUND ENGINEERING

By
H. M. TREMAINE, D.Sc.
College of Audio Engineering
University of Hollywood

Part 6. A discussion of the type of equalization required by the various kinds of sound systems.

BASICALLY, sound systems used in broadcast, commercial recording, motion pictures, and television are quite similar in nature and, in general, require much the same equipment.

Flexibility in operation is of prime importance because of the great variety of combinations of equipment required, and the many different situations arising during production, also the frequency characteristics of the sources of sound which are employed. In the broadcasting industry the source of sound may be from a remote point transmitted over a telephone line, a live pickup from a studio, or a recorded program from magnetic tape or a record. If we include television much of the recorded material will be from film.

Each of the sources or systems of reproduction will require individual consideration with respect to frequency response if the best reproduction is to be obtained. This means that the equalization for each type reproduction will be different and will vary with different recordings. It is necessary, therefore, that equalization be variable over a wide range.

It is the purpose of this series to discuss the different methods which may be employed in order to obtain good commercial sound recording and reproduction, and not to recommend any particular system or equipment.

Fig. 1 is a basic block diagram of a sound system employing a single amplifier for both recording and reproduction. Most laymen believe that if an amplifier has flat frequency characteristics, it will produce the best sound. This is true within certain limits. Amplifiers with uniform frequency response are desirable, but some means must be provided to compensate for the frequency response of recorded program material and the recording characteristics of the recording media. Even when the program is picked up from a studio, it will require some equalization to secure the best results.

Manufacturer	*Speed*	*Turnover*
Columbia and Mercury	78	300 cps
Columbia and Mercury	33⅓	500 cps
RCA	78	500 cps
Decca ffrr	78	300 and 400 cps
Technicord	78	650 cps
Miscellaneous	78	250,700,100 cps
Vertical Recording	33⅓	400 cps

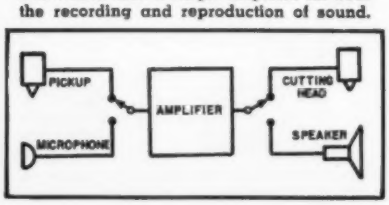
Table 1. Turnover frequencies for most of the better-known recording labels.

Professional audio systems generally use amplifiers of wide range, low distortion and noise, and uniform frequency characteristics, then insert devices for frequency correction external to the amplifiers. These devices are of low impedance and may be "patched" into the system at various points to secure the desired correction.

Referring again to Fig. 1, at the left is an electric pickup unit for record reproduction and a microphone for live pickups. At the right is a cutting head for recording disc records and a loudspeaker for playbacks and monitoring. Switches are provided at both the input and output for selecting the various combinations of the equipment.

Using the system as shown, with an amplifier of flat frequency characteristics, would result in fair reproduction. However, a problem immediately presents itself in the case of record reproduction. No standard recording characteristic has been set up by the various recording companies. Each recording activity has its own idea of what constitutes the best recording characteristic. This may be confirmed by checking the turnover frequency in the recording characteristics of the several leading record manufacturers. A summary of these characteristics is given in Table 1.

Fig. 1. Basic block diagram of a sound system which uses a single amplifier for both the recording and reproduction of sound.



This problem, coupled with the response of the reproducer unit, poses a problem for the audio engineer, as he may be called upon to switch from one frequency characteristic to another several times in a program while keeping the *over-all* sound quality uniform. It may be seen that if the amplifiers of the system were corrected within themselves for one type of reproduction, they would not be suitable for other types of reproduction or recording.

For disc record reproduction, the equalization takes into consideration the frequency of the turnover and the constant-amplitude / constant-velocity characteristics of the recording head. Magnetic tape recording and reproduction must be compensated to include the response of the tape and any variations in the recording and reproducing heads. Generally, the characteristics of the magnetic tape itself will be quite uniform and if the recorder is properly equalized it will be suitable for most tapes.

Magnetic tape requires a special form of equalization known as "pre and post" equalization. This compensation is divided between the recording and reproducing sections and is fixed in the recorder. The frequency response will vary somewhat from machine to machine and also with different manufactures. Generally, tape is played back from the reproducer unit through a "flat" channel. With proper equalization the greatest variation in reproduction will probably come from studio characteristics and from microphone placement in the original recording.

So far we have confined most of our discussion of frequency compensation to reproduction; however there are similar problems involved in recording. For 16-inch transcriptions running at a speed of 33⅓ rpm we may use the recording frequency response recommended by NARTB, or base it on the *reproducing* curve recommended by the Audio Engineering Society (Fig. 2). For microgroove discs running at 33⅓ rpm, the characteristic is similar to that used for standard 16-inch 33⅓ rpm, except for the low end which is down 13 db at 50 cps rather than 16 db. For 45 and 78 rpm discs the characteristic may be a so-called flat one with a small rise starting around 4000 cps. and continuing out to 10,000 cps.

For film recording and reproduction the equalization must include compensation for the losses of the reproducer optical system and laboratory processing. The equalization will vary with the type system and whether it is 16 mm or 35 mm film. If the recording channel is used for straight film recording, the compensation required for the processing losses may be incorporated in the microphone preamplifier.

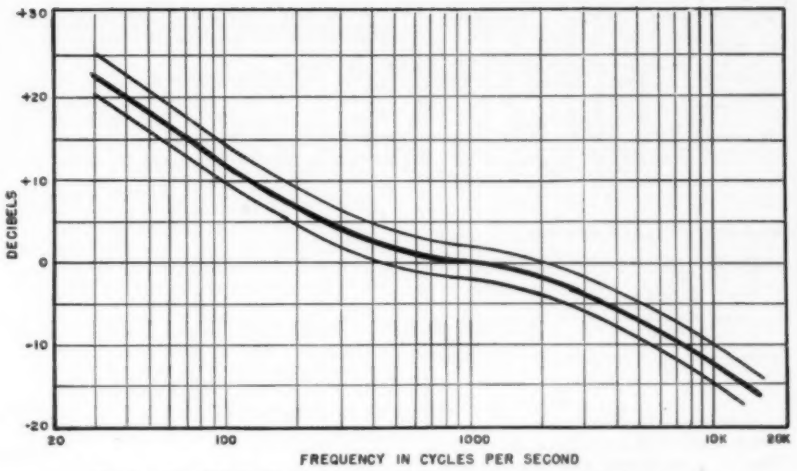
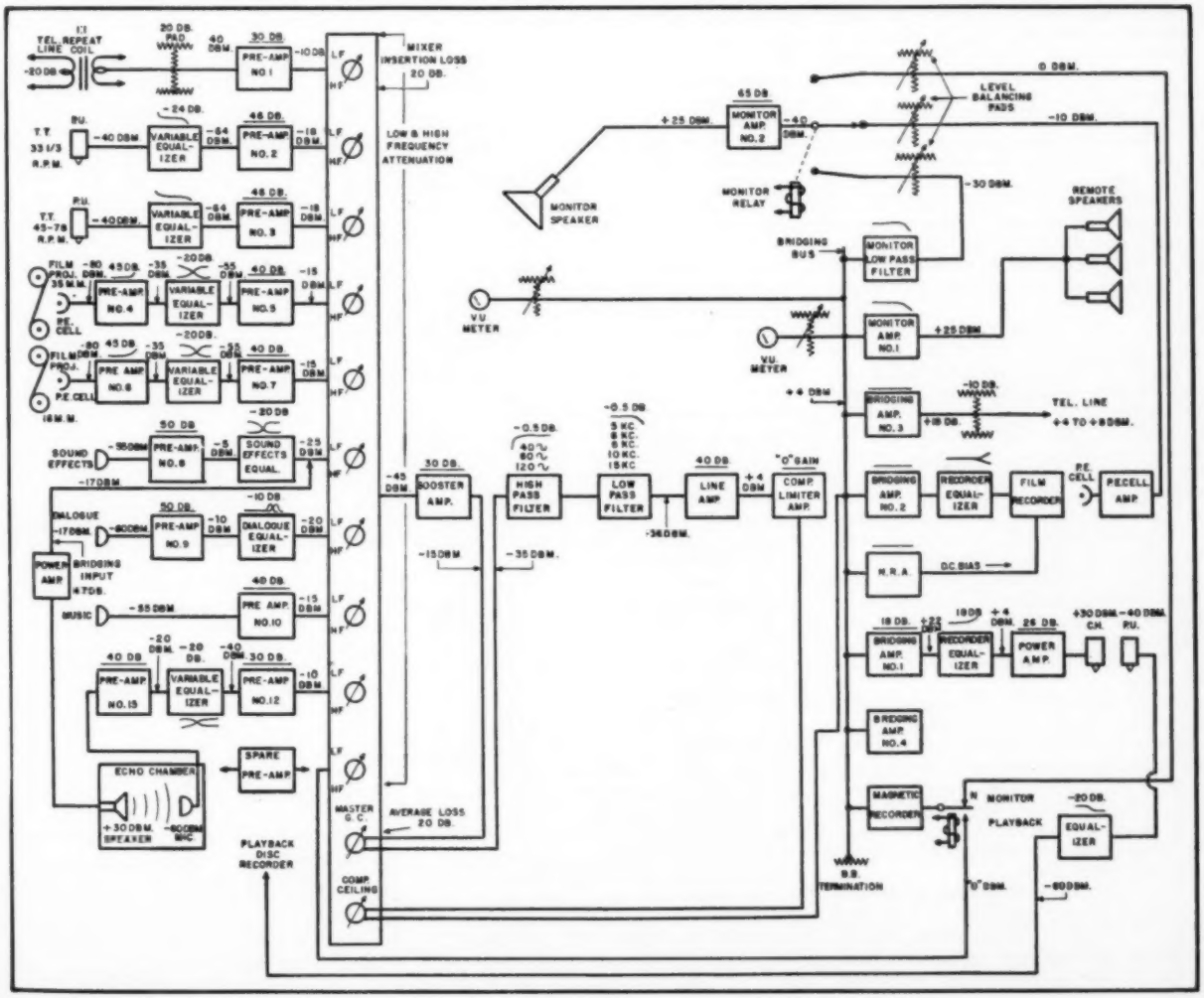


Fig. 2. The AES (Audio Engineering Society) standard reproducing curve.

For film recording in television where the preamplifiers are used with other equipment this is not practical. In this case, the equalization is inserted in the system at the film recorder where it cannot be removed by accident. Also, it may be changed for either 16 mm or 35 mm recording.

Fig. 3 is a block diagram of a composite sound channel for both record-

Fig. 3. Block diagram of a composite sound channel for recording and reproducing. Disc, magnetic tape, and film recorders are included.



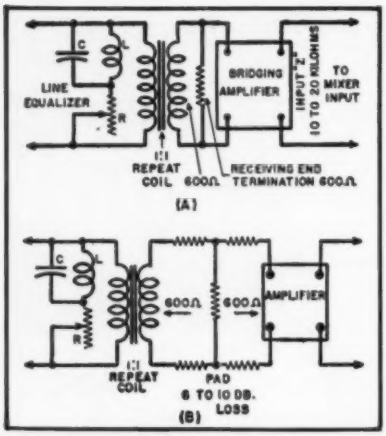


Fig. 4. Method of connecting audio equipment to a telephone transmission line.

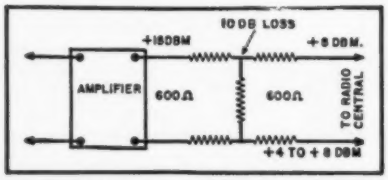


Fig. 5. When program material is transmitted to a remote point, the output of the equipment feeding the line must be isolated by means of pad of at least 10 decibel loss.

ing and reproduction. Included are disc, magnetic tape, and film recorders with their equalizers for obtaining individual frequency characteristics for each type of recording. Three types of monitoring have been provided to allow listening checks of the program material at the bridging bus or at the recorders. As stated before, this block diagram is *not* intended to represent any particular installation, but is a composite system to illustrate the requirements imposed and the various pieces of equipment that may be necessary to achieve a certain result. Above each unit is its frequency characteristic, gain or loss, and the approximate input and output levels. In actual practice, equipment will be patched in and out as required. In the production of television shows, it is not uncommon to use all systems of reproduction and recording shown in the diagram at some time during the production. No attempt has been made to include stage playbacks for process shots. As we progress with the diagram, the details of each piece of equipment will be discussed.

It will be assumed throughout this discussion that all impedances are matched and that the input circuits of the amplifiers following an equalizer or filter presents a "solid" termination. The microphone and photocell amplifiers may be operated open circuit (unterminated secondary), if desired, to obtain more gain.

The first source of sound to be encountered is at the upper left of the diagram, from a remote point, and is being received over a telephone line. As a rule, telephone lines are equalized for a definite frequency response, which will be determined by the service it is to render.

For FM transmissions the line is equalized within plus or minus 1 db from 30 to 15,000 cycles; AM broadcast 50 to 10,000; and for other services not requiring such a wide frequency range 80 to 5000 cycles.

The equalizer is adjusted by the telephone company and placed at the receiving end of the line or terminal point. A 600-ohm repeat coil is included with the equalizer to isolate the line from the terminal equipment, Fig. 4A. The output side of the repeat coil is terminated by the user and connected to the input of a bridging amplifier which may be a preamplifier modified for this purpose. The output of this amplifier is fed directly into the mixer input.

If it is desired, the output of the line repeat coil may be fed into an amplifier with a matched input of 600 ohms. However, when this type connection is made it is desirable to connect a pad of at least 6 db loss between the output of the line and the input of the amplifier, Fig. 4B. The purpose of the pad is to provide a "solid" termination for the line and "isolate" it from the terminal equipment. Pads used for this purpose are often referred to as "n" db of isolation. It is important that the configuration of the pad conform to the input circuit of the terminal equipment.

When program material is to be transmitted to a remote point, the telephone company requires that the transmitted level at the sending end be within the limits of plus 4 to plus 8 dbm. Also, that the output of the equipment feeding the line be isolated by a pad of at least 10 db loss, Fig. 5. This circuit is also shown at the right of the block diagram at the lower end of the bridging bus. The amplifier feeding line must, of course, have sufficient power output to overcome the loss of the pad and still produce a level of plus 8 dbm at the output of the pad. This will require an amplifier with a minimum power output of plus 18 dbm.

The next source of sound shown is a transcription turntable running at a speed of 33⅓ rpm. Transcription turntables designed for broadcast generally have a pickup equalizer installed as an integral part of the equipment and a preamplifier to compensate for the loss of the equalizer which generally runs about 24 db. The average output level of a pickup is approximately minus 40 dbm. Adding the loss of the equalizer to the output level of the pickup results in an output level of a minus 64 dbm at 1000 cycles. For turntables without equalization, a variable equalizer that will provide standard response curves as well as other characteristics will be required. Several excellent articles on this subject have appeared in previous issues of this magazine.

The output of the equalizer is fed into a preamplifier of 46 db gain which results in an output level of minus 18 dbm, a convenient input level for the mixer. A second turntable for 45 and 78 rpm record reproduction is also shown; the same conditions prevail here as for the 33⅓ rpm unit.

Below the turntables are shown two film projectors for television use. Both machines are shown with their output circuits fed from a photocell preamplifier directly into the mixer console.

As a rule, the preamplifier is placed either near or in the projector housing to increase the signal-to-noise ratio; however, some machines take the output signal from the photocell through a transformer and the preamplifier is installed at a distant point. The first method is to be preferred.

Sixteen millimeter motion picture prints generally present the greatest problems in television transmission as they employ a different frequency response from 35 mm film; also, many companies producing 16 mm films do not adhere to any particular frequency characteristic. The many different methods used to produce 16 mm films, coupled with the fact that some are optically printed from 35 mm originals, complicates the situation.

In either case equalizers will be required to compensate for the difference in recording characteristics of the film projected. When films of recent production made for regular theater use are projected, the frequency characteristics and levels are fairly uniform and will require little correction. However, the majority of motion pictures transmitted by television stations today were made several years ago when the frequency characteristics and levels were not as closely controlled. Also, at that time, the industry was undergoing changes in methods of recording and processing. It was not uncommon to find pictures being transmitted by television that were recorded many years ago using a "glow" tube, the original recording system developed by De Forest.

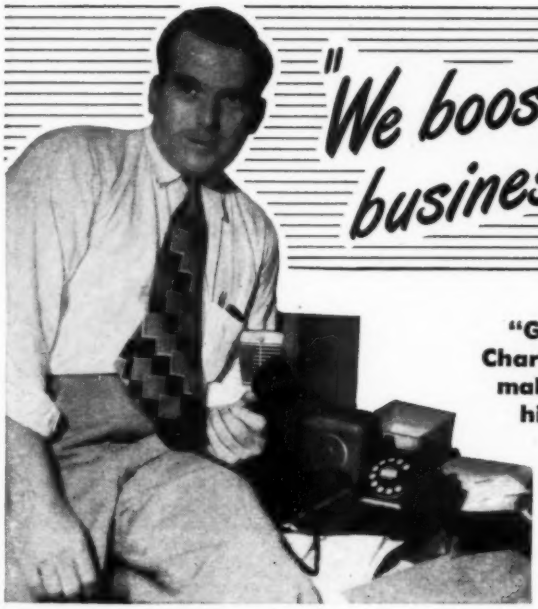
Foreign productions of early vintage are very spotty in level and frequency response and require constant frequency and level correction throughout their length.

If the production is old, it may have a high background noise, yet the print may be in good shape. A reduction in the high frequency response will reduce the background noises with a consequent sacrifice of the high frequencies. This must be done with care, however, or the intelligibility of the dialogue will suffer. Again, the sound may lack high frequency response which is generally the case with early-day productions. If the background noise is not too great, the high frequency response may be increased. If so, the low frequencies must be increased to balance the increase in high frequencies. This is necessary to maintain the correct aural balance.

It should be remembered that motion pictures made for theater reproduction will not always sound right even on a television receiver with a good audio channel. This is because the recording characteristics for motion pictures were determined by making a survey

(*Continued on page* 84)

"We boosted our TV service business 400% in one year!"



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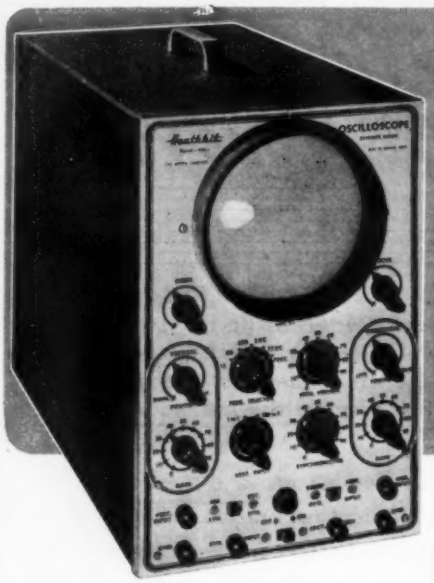

Heathkit MODEL 0-6 . . . PUSH-PULL . . . 5"
OSCILLOSCOPE KIT

The new Heathkit 5" Push-Pull Oscilloscope Kit is again the best buy. No other kit offers half the features — check them.

Measure either AC or DC on this new scope — the first oscilloscope under $100.00 with a DC amplifier.

The vertical amplifier has frequency compensated step attenuator input into a cathode follower stage. The gain control is of the non frequency discriminating type—accurate response at any setting. A push-pull pentode stage feeds the CR tube. New type positioning control has wide range for observing any portion of the trace.

The horizontal amplifiers are direct coupled to the CR tube and may be used as either AC or DC amplifiers. Separate binding posts are provided for AC or DC.

The multivibrator type sweep generator has new frequency compensation for the wide range it covers: 15 cycles to over 100,000 cycles.

The new model 0-6 scope uses 10 tubes in all, including 5" CR tube. Has improved amplifiers for better response useful to 2 megacycles. Tremendous sensitivity .04V RMS per inch horizontal — .09V RMS per inch vertical. Only Heathkit Scopes have all the features.

New husky heavy duty power transformer has 50% more laminations. It runs cool and has the lowest possible magnetic field. A complete eletrostatic shield covers primary and other necessary windings and has lead brought out for proper grounding.

The new filter condenser has separate sections for the vertical and horizontal screen grids and prevents interaction between them. An improved intensity circuit provides almost double previous brilliance and better intensity modulation.

A new synchronization circuit allows the trace to be synchronized with either the positive or negative pulse, an important feature in observing the complex pulses encountered in television servicing.

Model 0-6..... Shipping Wt. 24 lbs.

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The kit is complete; all tubes, switches, cabinet, power transformer and all other parts, plus a clear detailed construction manual.

Model S-2
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A new 30,000 V DC Probe Kit to handle high voltages with safety. For TV service work and all other high voltage applications. Sleek looking — Two color molded plastic — Red body and guard — jet black handle. Comes with connector, cable, and PL55 type plug. Plugs into Heathkit VTVM so that 300V scale is conveniently multiplied by 100. Can be used with any standard 11 megohm VTVM.

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This RF Probe Kit comes complete with probe housing, crystal diode detector, connector, lead and plug and all other parts plus clear assembly instructions. Extends range of Heathkit VTVM to 250 Mc. ± 10%. Works on any 11 megohm input VTVM. Specify No. 309 RF Probe Kit.

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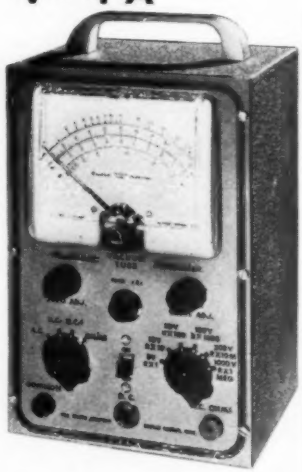
New MODEL V-4A *Heathkit*
VTVM KIT



The new Heathkit Model V-4A VTVM Kit measures up to 30,000 Volts DC and 250 megacycles when used with accessory probes — think of it, all in one electronic instrument more useful than ever before. The AC Voltmeter is so flat and extended in its response (± 1 db from 20 cycles to 2 megacycles) that it eliminates the need for separate expensive AC VTVM's.

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Voltage ranges are full scale — 3 Volts, 10 Volts, 30 Volts, 100 Volts, 300 Volts, 1000 Volts. Complete decading coverage without gaps.

The DC probe is isolated for dynamic measurements. Negligible circuit loading. Gets the accurate reading without disturbing the operation of the equipment under test. Kit comes complete: cabinet, transformer, Simpson meter, test leads, complete assembly and instruction manual.

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Heathkit TV ALIGNMENT GENERATOR KIT

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The instrument provides a frequency modulated signal covering, in two bands, the range of 10 to 90 Mc. and 150 to 230 Mc. — thus, ALL ALLOCATED TV CHANNELS AS WELL AS IF FREQUENCIES ARE COVERED.

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Sweep width is controlled from the front panel and covers a sweep deviation of 0-12 Mc. — all the sweep you could possibly need or want.

And still other excellent features are: Horizontal sweep voltage available at the front panel (and controlled with a phasing control) — both step and continuously variable attenuation for setting the output signal to the desired level — a convenient instrument stand-by position — vernier drive of both oscillator and marker tuning condensers — and blanking for establishing a single trace with base reference level. Make your work easier, save time and repair with confidence — order your Heathkit TV Alignment Generator now!

$39.50

Model TS-2
Shipping Wt. 20 lbs.

Heathkit SIGNAL GENERATOR KIT

Model SG-6
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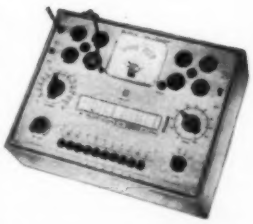
The new Heathkit Signal Generator Kit has dozens of improvements. Covers the extended range of 160 Kc to 50 megacycles on fundamentals and up to 150 megacycles on useful calibrated harmonics; makes this Heathkit ideal as a marker oscillator for TV. Output level can be conveniently set by means of both step attenuator and continuously variable output controls. Instrument has new miniature HF tubes to easily handle the high frequencies covered.

Uses 6C4 master oscillator and 6C4 sine wave audio oscillator. The kit is transformer operated and a husky selenium rectifier is used in the power surply. All coils are precision wound and checked for calibration making only one adjustment necessary for all bands.

New sine wave audio oscillator provides internal modulation and is also available for external audio testing. Switch provided allows the oscillator to be modulated by an external audio oscillator for fidelity testing of receivers. Comes complete, all tubes, cabinet, test leads, every part. The instruction manual has step-by-step instructions and pictorials. It's easy and fun to build a Heathkit Model SG-6 Signal Generator.

Heathkit TUBE CHECKER KIT



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Test your tubes the modern way — dynamically — the simplest, yet fastest and surest method — your Heathkit has a switch for each tube element and measures that element — no chance for open or shorted elements slipping by, all the advantages of the mutual conductance type without the slow cumbersome time consuming setups. Checks for opens, shorts, each element individually, filament and filament tap continuity, and emission.

This Tube Checker has all the features — beautiful 3 color BAD-?-GOOD meter — complete selection of voltages — roller chart listing hundreds of tubes including the new 9 pin miniatures — finest quality Centralab lever switches — high grade birch, counter-type cabinet — continuously variable line adjust control — every feature you need to sell tubes properly. The most modern type tube checker with complete protection against obsolescence. Uses only the best of parts — rugged oversize 110V 60 cycle power transformer, finest of Mallory and Centralab switches and controls, complete set of sockets for all type tubes with blank spare for future types. Fast action, gear driven roller chart quickly locates the setting for any type tube. Simplified switching cuts necessary testing time to a minimum and saves valuable service time. Simple method allows instant setup of new tube types without waiting for factory data. No matter what the arrangement of tube elements is, the Heathkit flexible switching method easily handles it. Order your Heathkit Tube Checker Kit today and see for yourself that Heath again saves you two-thirds and yet retains all the quality. Complete with instructions, all parts, and cabinet.

Heathkit SIGNAL TRACER and UNIVERSAL TEST SPEAKER KIT

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The popular Heathkit Signal Tracer has now been combined with a universal test speaker at no increase in price. The same high quality tracer follows signal from antenna to speaker — locates intermittents — finds defective parts quicker — saves valuable service time — gives greater income per service hour. Works equally well on broadcast, FM, or TV receivers. The test speaker has an assortment of switching ranges to match either push-pull or single output impedances. Also tests microphones, pickups and PA systems. Comes complete: cabinet, 110V 60 cycle power transformer, tubes, test probe, all necessary parts, and detailed instructions for assembly and use.

Heathkit CONDENSER CHECKER KIT

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Checks all types of condensers — paper, mica, ceramic, electrolytic. All condenser scales are direct reading and require no charts or multipliers. Covers range of .00001 MFD to 1000 MFD. A Condenser Checker that anyone can read. A leakage test and polarizing voltage for 20 to 500 V provided. Measures power factor of electrolytics between 0% and 50% and reads resistance from 100 ohms to 5 megohms. The magic eye indicator makes testing easy.

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A precision portable volt-ohm-milliammeter. Uses only high quality parts — All precision ½% resistors, three deck switch for trouble-free mounting of parts, specially designed battery mounting bracket, smooth acting ohm adjust control, beautiful molded bakelite case, 400 microamp meter movement, etc.

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Kit utilizes only highest quality parts, General Radio main calibrated control, General Radio hummer, Mallory ceramic switches, excellent 200 microamp zero center galvanometer, laboratory type binding posts with standard ¾ inch centers, ½% precision ceramic-body type multiplier resistors, beautiful birch cabinet and ready calibrated panel. (Headphones not included.)

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Heathkit LABORATORY

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Ship. Wt. 4 lbs.

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Designed to match the impedance bridge above, the Resistance Decade Kit has a beautiful birch cabinet and attractive panel. It's easy to build, and comes complete with all parts and construction manual.

NEW *Heathkit* SINE and SQUARE WAVE

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We proudly present the NEW MODEL Sine and Square Wave Audio Generator Kit. Designed with versatility, usefulness, and dependability in mind, the AG-7 gives you the two most needed waveshapes right at your fingertips — the sine wave and the square wave.

The range switch and plainly calibrated frequency scale give rapid and easy frequency selection, and the output control permits setting the output to any desired level.

A high-low impedance switch sets the instrument for either high or low impedance output — on high to connect to high impedance load, and on low to work into a low impedance transformer with negligible DC resistance.

Coverage is from 20 to 20,000 cycles, and distortion is at a minimum — you can readily trust the output waveshape.

6 tubes, quality 4 gang tuning condenser, power transformer, metal cased filter condenser, ½% precision resistors in the frequency determining circuit, and all other parts come with the kit — plus, a complete construction manual. A tremendous kit, and the price is truly low.

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MICHIGAN

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- ☐ Parcel Post
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Quantity	Item	Price	Quantity	Item	Price
	Heathkit Oscilloscope Kit — Model O-6			Heathkit R.F. Probe Kit — No. 309	
	Heathkit VTVM Kit — Model V-4A			Heathkit H.V. Probe Kit — No. 336	
	Heathkit FM Tuner Kit — FM-2			Heathkit R.F. Signal Gen. Kit — Model SG-6	
	Heathkit Broadcast Receiver Kit — Model BR-1			Heathkit Condenser Checker Kit — Model C-2	
	Heathkit Three Band Receiver Kit - Model AR-1			Heathkit Handitester Kit — Model M-1	
	Heathkit Amplifier Kit — Model A-4			Heathkit Power Supply Kit — Model PS-1	
	Heathkit Amplifier Kit — Model A-6 (or A-6A)			Heathkit Resistance Decade Kit — Model RD-1	
	Heathkit Tube Checker Kit — Model TC-1			Heathkit Impedance Bridge Kit — Model IB-1B	
	Heathkit Audio Generator Kit — Model AG-7				
	Heathkit Battery Eliminator Kit — Model BE-2				
	Heathkit Electronic Switch Kit — Model S-2				
	Heathkit T.V. Alignment Gen. Kit — TS-2				
	Heathkit Signal Tracer Kit — Model T-2				

On Parcel Post Orders, include postage for weight shown and insurance. (We insure all shipments.)

On Express Orders, do not include transportation charges — they will be collected by the Express Agency at time of delivery.

Enclosed find ☐ Check ☐ Money Order for_____

Please ship C.O.D. ☐ Postage enclosed for_____lbs.

ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE

EXPORT AGENT
ROCKE INTERNATIONAL CORP.
13 E. 40th St.
NEW YORK CITY (16)
CABLE: ARLAB N.Y.

The HEATH COMPANY
. . . BENTON HARBOR 15, MICHIGAN

MARS Station of the Month

MARS BEAMS WEEKLY BROADCASTS

MARS—Army Headquarters station, WAR, located at the Pentagon Building, Washington, D. C., broadcasts a weekly message each Tuesday at 0100Z and at 0400Z. (This is Monday at 8 p.m. and 11 p.m., Eastern Standard Time; Monday at 7 p.m. and 10 p.m., Central Standard Time; Monday at 6 p.m. and 9 p.m., Mountain Standard Time; and Monday at 5 p.m. and 8 p.m., Pacific Standard Time.)

Simultaneous broadcasts are made on frequencies 3497.5 kc., 6997.5 kc., 14,405 kc., and 20,994 kc. Each message is sent three times, once at 10 words per minute, once at 15 words per minute, and once at a higher rate of speed—usually 20 words per minute.

Designed especially to transmit quasi-official traffic and training information to MARS members, the broadcast offers an excellent opportunity for all amateurs to build up their code proficiency.

YOU couldn't tell it from the call letters but AF2SDX is an early bird. He holds the first MARS certificate granted for civilian affiliation with the MARS-Air Force. As a reward for his enthusiasm and early application 2SDX has been named Station of the Month by Captain Charles C. Mack, Chief of MARS-Air Force.

AF2SDX is located at Griffis Air Force Base, Rome, New York. The handle is "Ernie," short for Ernest Storrs, a native of Michigan, expert on Ground Control Approach (GCA) equipment, and engineer with Research and Development at Griffis AFB. Ernie had been waiting for the civilian amateur authorization since MARS first was activated in 1948.

Ernie works all bands but confesses that he prefers 20 meter phone. The big rig at AF2SDX features a pair of 813's modulated by a pair of 811's and runs about 450 watts input. The all-band exciter unit is a modified surplus 696 with a self contained power supply. A *Patterson* PRC-16 receiver completes the station layout.

AF2SDX reports that there are a number of amateurs at Griffis, about 40 of whom are civilians and potential "MARTIANS." The group has formed a Base Club. They have recently acquired and renovated a building at the Base, and are now equipping it for deluxe operation. Operating positions are being engineered to put four transmitters on the air simultaneously. A classroom is being built for instruction in code and theory. A library, study room, and lounge round out the plush installation.

The key figure in this planning is, of course, Ernie. -30-

Ernest Storrs of Griffis Air Force Base, Rome, New York, gets a handshake from Major General F. L. Ankenbrandt, Director of Communications, USAF, as he receives the first MARS certificate awarded a civilian member of the Air Force MARS.

WESTERN UNION'S NEW EAST ORANGE TV SERVICE CENTER

THE recent announcement that Western Union intended to enter the TV servicing field has caused quite a stir in the television industry.

Because of the varying opinions as to the wisdom of such a move, RADIO & TELEVISION NEWS' Eastern Editor, Harold Becker, recently made a trip to Western Union's East Orange, N. J. service center to gather up-to-the-minute details on this operation.

Although located in East Orange, this first service outlet is covering the New Jersey counties of Hudson, Bergen, Essex, Union, and Passaic.

This present operation is considered to be a "pilot" operation by means of which Western Union can determine whether or not such a venture can be operated profitably.

The location of this first service center was chosen only after a careful study was made to determine how many television receivers were in the hands of the public in this area and the servicing potential. This study showed that there were approximately 30,000 Du Mont receivers installed in these five counties.

The present operation comprises a crew of seven television technicians and a fleet of seven service cars and two service trucks. All parts and other equipment are purchased through local electronic parts distributors. With this setup, the company reports an average business of $250.00 a day.

In many instances, Western Union's price schedule, as shown in the table below, is slightly higher than for other service outlets in the area. Most of the sets are serviced on a per-call basis for which the charge is $6.00 plus the cost of parts.

Most of the service business has been confined to the Du Mont line. The principal means of promoting business has been through local advertising since they have been unable to obtain a list of Du Mont set owners from the local Du Montdistributor. Since these names are not available to other dealers, the local distributor deemed it inadvisable to make the list available to the Western Union organization.

The over-all picture seems to indicate that the infant service organization is developing at an orderly pace and it is quite likely that they can make a success of the local enterprise. However, unless other manufacturers follow Du Mont's lead, it seems very unlikely that they will be able to promote a similar volume of business in other communities. Although negotiations are going forward daily, Western Union has not lined up any other company at the present time.

Because of the high percentage of Du Mont sets in the East Orange area, this particular section of the country was an especially favorable spot for Western Union to launch its first service venture.

—30—

Television Only Pix Tube	Standard Installation and First Year's Service	Standard Installation and First three months' Service	*Built in Antenna First Year's Service	*Built in Antenna First three months' Service
15", 16", 17"	75.00	55.00	55.00	25.00
19", 20"	85.00	60.00	60.00	30.00
30"	100.00	65.00	75.00	45.00
Extra for Radio, Phono, Tape recorder, preselector clock	7.50 each	5.00 each	7.50 each	5.00 each

*Built in antenna prices apply when existing antenna is used. Indoor V antenna $5.00 extra.

Western Union Services, Inc.'s price schedule for TV installation and service.

Western Union's East Orange service center and one of the company's service fleet.

OUTSTANDING VALUES NOW AVAILABLE

PRE-AMPLIFIER for RELUCTANCE CARTRIDGE

Made by Magnavox. Complete with tubes 6SG7, 6SQ7, 6J7. All wired, ready for use. A remarkable value!

ONLY.....**$2.95**

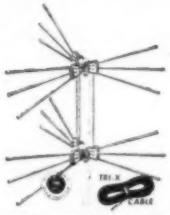
HARD-TO-GET TUBES
Fully Guaranteed

Quantities Limited—Subject to Prior Sale.

1B3GT...	**$1.06**	6K6GT...	**$ .59**
5Y3GT...	**.49**	6BC5....	**.79**
6AK5....	**1.47**	6CB6....	**.79**
6AL5....	**.79**	6BH6....	**.89**
6AQ5...	**.79**	6BJ6.....	**.79**
6AU6....	**.79**	12AT7...	**1.29**
6AV6....	**.65**	12AU6...	**.79**

2X2A....**$ .55**

SNYDER DIRECTRONIC MOTORLESS TV AERIAL SYSTEM



Receive fine signal from all directions. No longer necessary to use Yagi antennas for each band. No longer necessary to use antenna rotors. SWITCH AT SET CONTROLS ELEMENTS IN EFFECT. Simple to install, easy to use.

- All channels for ultra-fringe areas.
- Hi-tensile ⅜" aluminum alloy elements.
- 1 set connecting stubs.
- Universal U clamp for masts up to 1½".
- Directronic Beam Selector.
- 75 feet of TRI-X cable.

COMPLETE....**$16.95**

PHONO CARTRIDGES—Brand New—Will replace 95% of all cartridges.
1 volt—Standard Mounting.**$1.75** ea.
3½ volt—Standard Mounting.**$1.85** ea.

MOST AMAZING SPEAKER MADE! THE "JUNIOR TWELVE"

Size: 5¼". Standard Mounting. 2.15 oz. Alnico V Magnet. ¾" Voice coil impedance 3.2 ohms. Get 12" speaker performance in smaller radio sets, phonographs, TV sets, and sound systems! —at 5" speaker prices! Fundamental resonance of the "Junior Twelve" centers around 85 cycles. Response of the "Junior Twelve" is that of the conventional 12" PM.

NOW ONLY....**$2.79** ea.

REDUCE YOUR TV RECEPTION TROUBLE

THE TURRET BOOSTER

- Fully concealed within set.
- Comes on when receiver is turned on.
- No wiring necessary—simple as removing a tube.
- Improves reception—increases video output at least 15%.

Just the thing for fringe area boost or in local areas where antennas are not allowed. PRICE.....**$9.95**
(Special discount to dealers)

BUFFER CONDENSERS

.005 —2000 V...
.006 —1600 V...
.0075—2000 V...
.01 —2000 V...

25c each
10 for **$2.25**
100 for **$19.50**

OZ4 Tubes. Fully Guaranteed.
69c each. 10 for **$6.50**

SPEAKER BUYS OF THE YEAR

4" PM Alnico V Magnet
5" PM Alnico V Magnet

$1.49 each
10 assorted for $14.25

THE PERFECT SPEAKER FOR REPLACEMENT OR SOUND WORK

10" PM 3.15 oz. Alnico V Magnet. Rated at 15 watts.....**$3.95** each.
6 for **$3.75** each.

TUBE CARTONS

Made of heavy red stock. For miniature tubes.

$1.25 for 100.
$11.00 for 1000.
GT OR METAL TUBES
100 for **$1.50**
1000 for **$12.50**

CUSTOM BUILT AUTO RADIOS

Easily installed. Fine, top quality. Ready to place in your car. Designed for each specific car.

All sets—6 tube. 3 gang; super heterodyne. Extra sensitive circuit. Low battery drain. Beautiful finish and dial. These models now available:

1951—Ford
1949-50—Ford
1951—Chevrolet
1949-50—Chevrolet
1950-51—Studebaker
1948-49-50-51—Hudson
1951—Henry J
1951—Dodge, Plymouth
1949-50—Dodge, Plymouth

List Price, **$59.95**
YOUR PRICE.....**$41.95**

HERE'S A REAL TOOL BUY

This handy, useful 6-piece set with unbreakable, shockproof, nonflammable amber handles, with flange aluminum screw chuck. Blades hardened, tempered and fully polished. In attractive leatherette pouch. NOW ONLY **$1.11** each.

Case of 12 sets.....**$12.00**

NOW! 20" PICTURE FROM YOUR SMALLER SCREEN SETS

Raparco 20" conversion kit at an all-time low price!

Includes 20CP4 tube, 20" gilt edged mask, matching 70° yoke and 15KV HV transformer. All finest quality components. COMPLETE for.....**$69.95**

CHIMNEY MOUNTS—2 piece heavy-duty, rust-proof brackets. No drilling or guy wire needed. Includes strapping. **$1.30** each 12 for **$1.20** each

Radio Parts Company, 614 RANDOLPH ST., CHICAGO 6, ILL.

17" T.V. CONVERSION KIT ON SALE FOR $29.95

CONVERT TO A RECTANGULAR PICTURE

With each conversion kit you get a plastic mask, 70 degree deflection yoke, 90 day guaranteed black face picture tube, plus our new 7741-X 14,000 Volt Universal flyback and horizontal output transformer that works on any output tube and any single rectifier (1B3 or 1X2). A suggested diagram is furnished for use of the transformer with several different output tubes and rectifiers. We think this is the finest and best priced conversion kit in the country. Shipped Truck or Express, only.

Kit No. TCK-14, with 14HP4A 14" rectangular tube. Net price.....**$32.95**
Kit No. TCK-16, with 16RP4A 16" rectangular tube. Net price.....**34.95**
Kit No. TCK-17, with 17HP4A 17" rectangular tube. Net price.....**29.95**

PICTURE TUBE SALE

Values like this 1ZLP4, $17.95

Look over these picture tube prices and you will see, that for set replacement and conversion use, McGee offers you more for your money. Every picture tube guaranteed full replacement for 90 days. Every tube is a tremendous value. These tubes are not seconds, but 1st quality.

NOTE: 10MP4 Replaces a 10BP4 Without Any Circuit Changes.

Tube No.	Diameter	Defl. Angle	Overall Length	Neck Length	Envelope	Face Type	Ion Trap	Net Price
10M P4	10"	53	17"	7-9/16"	Glass	Clear	Single	**$16.95**
12L P4	12"	50	18¾"	8¼"	Glass	Clear	Single	**17.95**
12M P4	12"	53	17⅛"	7"	Glass	Clear	Single	**17.95**
14B P4A	14" (R)	70	16-13/16"	7⅛"	Glass	Filter	Double	**19.95**
15D P4	15"	60	20¾"	7⅞"	Glass	Clear	Double	**29.95**
16A P4	16"	53	22-5/16"	7-9/16"	Glass	Clear	Double	**29.95**
16J P4	16"	60	20¾"	7⅛"	Glass	Clear	Double	**22.95**
16G P4A	16"	70	17-11/16"	6⅞"	Metal	Filter	Single	**24.95**
16I P4	16"	52	22⅛"	7⅜"	Glass	Clear	Double	**29.95**
16R P4A	16" (R)	70	18¾"	7⅛"	Glass	Filter	Single	**24.95**
17B P4A	17" (R)	70	18¾"	7⅛"	Glass	Filter	Single	**22.95**
19D P4A	19" (R)	60	20¾"	8½"	Glass	Filter	Double	**39.95**
20C P4A	20" (R)	70	21⅜"	7"	Glass	Filter	Double	**39.95**

Note: (R) Designates a rectangular type tube. 10M P4 perfect for 10B P4.

BRAND NEW R. C. A. TELEVISION FRONT END-TUNERS

Sale Price $14.95

A fortunate purchase from a T.V. set manufacturer makes this value possible. RCA 13 channel completely wired, tested and aligned T.V. tuner. A 13 channel selector switch with outer sleeve fine frequency control. Converter output transformer is attached for direct coupling to video and sound I.F. stages. Shaft length, 3⅜". Original dealer's cost on this item was over **$30.00.** McGee offers them to you brand new (they have never been soldered to or in sets) for only **$14.95**, less tubes. 3 6J6 tubes required. Shipping weight 2 lbs. Stock No. RCA-13P, less 3 6J6 tubes. Net **$14.95**. two for **$27.95**.

T.V. BOOSTER REGENCY $19.10

Regency DB-410 television booster. A real engineered unit, small and compact. Slug tuned, using 1—6J6 tube as neutralized push-pull amplifier. Dollar for dollar, your best booster buy. 53⅛" x 43⅝". For 110 volt AC operation. Weight 6 lbs. Net price **$19.10.**

Astatic AT-1, "Channel-Chief" booster. Two tuned circuits and two broad circuits on all channels. Dual controls tune sound and picture independently. 8½x6½x7¼". Weight 6 lbs. Net price, **$32.05.**

Astatic BT-1 television booster. For either 72 or 300 ohm input and output. Woodgrain metal cabinet. Weight 4 lbs. Net **$19.10.**

NEW UNIVERSAL FLYBACK $3.95

Why pay up to $7.50 for a flyback when McGee offers you this new 1951 Universal flyback for only $3.95 with suggested diagram furnished. A newly designed unit, the 7721X sweep transformer incorporating a ceramic core, has proven versatile in application to directly viewed picture tube from 8AP4 to 20CP4 designed to operate at supply levels from 125 to 325 volts with power tubes such as 19BG6-G, 6AC5-GT, 6BQ6-GT, or 6BG6-G, and with damper tubes such as 6AS7-G, 5Y4-G, or 6W4-GT within all rating limits to produce adequate sweep and high voltage power with a single 1B3-GT or 1X2 rectifier at 8 kv for the 8AP4 (54 degrees sweep) and at 14 kv for the 20CP4 (70 degrees sweep) OR ANY PICTURE TUBE. Rectangular or Round 10", 14", 16", 17", 19". Net **$3.95**, 3 for **$11.00.**

NEW 17-INCH TELEVISION KIT

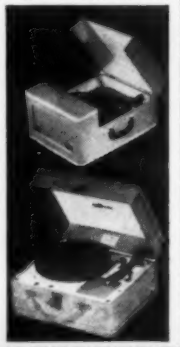
TUNER AND VIDEO READY WIRED $59.95 LESS ALL TUBES

A complete kit of parts to build a transformer operated AC Television chassis for use with a 16" or 17" Rectangular or Round picture tube, with a 12 channel wired Sarkes Tarzian tuner. The 7 tube video strip for sound and picture IF stages is already wired, this makes for much less work in building your TV set. Circuit features latest ceramic flyback, full 225 mil power transformer, ready punched chassis, and 70 degree deflection, and a straight forward circuit. A complete schematic diagram is furnished. Only those who understand TV and can follow a schematic diagram should buy this kit. Shipping weight 40 lbs., Model WH-10 price, less all tubes, **$59.95.** Kit of tubes, except picture tube: 6AT6, 6V6, 6W4, 6J6, 2 6AL5, 3 6AU6, 6AG5, 4 7N7, 5U4, 1X2, 6BG6. **$16.95** extra. 16" or 17" Blackface Rectangular picture tube **$31.95** extra. Mask is included at no extra cost when kit is ordered with tubes.

LOOK AT THESE BARGAINS!

TRAV-LER 3-WAY PORTABLE — $18.95

A lucky purchase makes this value possible. Model 5022 Trav-Ler 3 way portable. Operates on 105 to 125 volts AC or DC, or self-contained batteries. A full 2 gang superhet with Alnico V dynamic speaker. Tube component: 1R5, 1U4, 1U5, 3V4, plus rectifier. Has vernier airplane dial. A smartly styled two-tone portable with ivory plastic front panel and Tan or Red leatherette covered case. Compact size 9 x 5⅛ x 5¼". Loop antenna is built in. Receives broadcast 550 to 1600 kc. A powerful set with 6 tube performance. Shipping weight, less batteries, 6 lbs., (7 lbs. with batteries). Trav-Ler Model 5022, portable less batteries **$18.95** ea. Lots of 3 **$18.50** ea. Battery kit for Model 5022 **$1.75** extra, consists of one 67½ volt 'B' and 2 No. 2 flashlight cells.



VM 3-SPEED AUTOMATIC—$44.95

Another special purchase offer! VM-975, 3 speed portable automatic record changer. Housed in a deluxe brown leatherette case; 14½ x 17½ x 8¾" high. Famous VM Tru-Matic changer, plays all 3 speed and all 3 sizes automatically. 10 and 12" records of the same speed can be inter-mixed. Flip-over crystal cartridge provides the correct needle size for the record you are playing. Has good quality 3 tube amplifier, a tone and volume control and heavy magnet PM speaker. Regular price is $51.60. Now, a limited number are available at the special sale price of only **$44.95** each. Shipping weight 22 lbs.

TRAV-LER 3-SPEED PORTABLE—$18.95

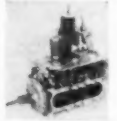
Trav-Ler Model 7033, deluxe 3-speed electric portable record player. Powerful 3 tube amplifier, (12SQ7, 50L6, and 35Z5 rectifier). Full size Alnico V magnet, dynamic speaker. Plays all records: 7", 10" and 12". 33⅓, 45 and 78 RPM. Crystal pickup, with all purpose truncated permanent needle. Luggage style case, 12⅛ x 10½ x 6¼", expertly covered with simulated Tan, Green, or Red leatherette. Shipping weight 11½ lbs. Trav-Ler Model 7033, 3-speed portable electric record player. Net price only **$18.95.** Lots of 3, **$18.50** each.

SARKES-TARZIAN

13-CHANNEL T.V. FRONT END

WITH TUBES AND DIAGRAM $79.95

This popular Sarkes-Tarzian television front end is widely used today. The 13 channel rotary switch type with individually tuned coils. Price includes a schematic diagram and 3 tubes, 6C4 osc, 6BH6 RF and 6AG5 mixer. Regular factory cost is twice our price. Each tuner and its own tube sockets are wired, ready to hook up to a video and sound IF strip. May be used with either intercarrier or separate sound IF circuits. Built-in fine frequency control. Ship. weight 3 lbs. Sarkes-Tarzian Type TV tuner with tubes net.....**$7.95**
Combination deal. Sarkes-Tarzian TV tuner and 205-XX video coil kit, both for...**$14.95**
Sarkes-Tarzian Type 3—Same as Type 2 only has input IF coil built-on. Tapped for sound IF channel. Net.....**$9.95**
Sarkes-Tarzian Type 3 tuner and 205-XX coil kit both for.....**$16.95**



BRAND NEW GENERAL INST. TELEVISION FRONT END-TUNERS

Sale Price $7.95

All completely wired, brand new and prealigned, 13 channel selector incorporating fixed inductance and variable capacitance. Converter output transformer is attached to be coupled direct to separate sound and video I.F.'s. 3 6J6 tubes are required. Shaft length 2¼". Built in fine frequency control. Original factory cost over **$20.00.** Weight 4 lbs. Stock No. GI-13P, less tubes. Net price **$7.95.**

Stock #GI-13PX Same as above only not in new condition. Have been in sets, but guaranteed a good value—less tubes. G. Inst. Tuner—GI-13PX, net **$2.95.**

NEW 2-TUBE SARKES-TARZIAN T.V. TUNER

LESS TUBES $7.95

Sarkes-Tarzian new two-tube model, type TT-3A, 12-channel television tuner. This is the new two-tube model requiring a 6J6 plus 6AK5 or 6AG5, or 6CB6, or 6AU6 RF tubes. Pre-factory aligned by trained factory personnel. Input feeds 21 M.C. broad band. Fine tuning control is over the channel selector shaft. Power requirements 120 to 140 Volts D.C. at 17 Mills plus 6.3 Volt filament. This tuner is offered at a terrific saving to you. Stock No. TT-3A. Net price, **$7.95**; two for **$13.00**, less tubes. Specify shaft length desired.

Stock #TT-3A—with 2⅞" shaft, net **$7.95.** With 5⅛ or 7⅛" shaft **$1.00** extra. 6J6 and 6AU6 Tubes for above **$2.39** ea.

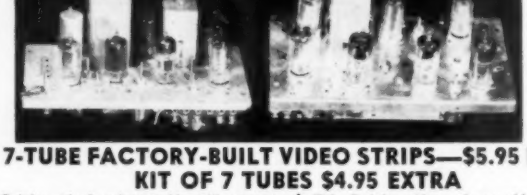
Video Coil Kit $7.95

20 matched TV video and sound I.F. coils. Intended for use with the RCA circuit. You get 4—peaking coils, 4—25.75 mc picture I.F.'s, 2—21.25 mc sound I.F.'s, discriminator and converter coil and 5 filament chokes. Stock No. 205-XX. Weight 3 lbs. Net price, **$7.95. $6.95** if purchased with ANY TV tuner: all coils identified.

300-Ohm TV Lead-in 100-Ft. Coil $2.49

Good quality polyethelene standard flat 300 ohm TV lead in wire, with stranded copper conductors. 100 foot coil **$2.49**; 1000 foot spool **$22.95.** 72 ohm coax 100 foot for **$6.95.** 6c per foot in larger quantities.

WRITE FOR McGEE'S LATEST BARGAIN FLYER. WHY PAY MORE THAN McGEE'S PRICE?



SCOOP

7-TUBE FACTORY-BUILT VIDEO STRIPS—$5.95 EACH KIT OF 7 TUBES $4.95 EXTRA

7 tube, wired, sub-assembly with separate I.F. Stock No. 15C577. Admiral sub-assembly for Model 24D1, etc. Any picture tube from 14" to 20". A completely wired sound and video IF strip. This is the most delicate portion of a TV receiver and offered at less than factory production cost. Requires 7 tubes, 2—6AU6, 6AG5 and 2 6AL5. Only a few connections necessary to any make 12 channel tuner such as Sarkes Tarzian, G. I., or R. C. A., etc. Sub-assembly has 1st sound IF (21.25 mc), 3rd video IF cathode trap, 2nd video IF (25.3 mc), 4th video IF (23.15 mc) 2nd sound IF, peaking coil, and ratio detector transformer. Requires 6AL5 video detector and sync clamper, 6AU6 1st sound IF, 6AU6 2nd IF, 6AL5 ratio detector, and three 6AU6's, 1st, 2nd, and 3rd video IF's. Printed diagram furnished. Stock No. 15C577. Shipping weight 2 lbs. less tubes **$5.95.** Kit of 7 tubes **$4.95** extra.

This 7 tube video sub-assembly was intended for use in Admiral intercarrier type, Model No. 20A1, etc. May be used with any size picture tube up to 20". Offered at less than factory production cost. Requires 7 tubes: 5 6AU6, and 2 6AL5. Now if you want to build a TV set here is the hardest part already finished for you. Used with 10" to 20" picture tube sets. Has ratio detector transformer, sound IF transformer, 2nd video IF (25.3 mc), 3rd video IF (23.1 mc), and 4th video IF (25.13 mc). Requires 6AL5 ratio detector, 6AU6 sound IF amplifier, 6AU6 video amplifier, 6AL5 video detector AGC, and three 6AU6 for 1st, 2nd, and 3rd video IF stages. Printed diagram furnished. Chassis measures 7⅛ x 5¾". Stock No. 5-1A7. Shipping weight 1½ lbs. less tubes **$5.95.** Kit of 7 tubes **$4.95** extra.

50-WATT BOOSTER AMPLIFIER—$39.95

25-Watt Horn $28.50 — 50-Watt Booster $39.95 — 2-Mike Pre-Amp. $10.00 Extra.

50-WATT BOOSTER A sensational value. 50 watt booster amplifier with push-pull parallel 6L6 output tubes. Connect to your present amplifier as a booster or use with the PR-2X Pre-amp to add the use of 2 mikes and one low level input. The booster amplifier has one input jack and with 1 volt input gives 50 watts of audio. Booster has a rugged, potted case high fidelity output transformer, matches speaker with 4-8-16 ohm voice coil, also 60 ohm and 250 ohm line. Booster has a 225 mil power supply with 5U4 rectifier. Price includes tubes: 4 6L6, 7N7 and 5U4. The two variable controls are for master volume control and bass boost tone control. Size 8 x 6¼ x 14¼". Stock No. PA-55X. Shipping weight 26 lbs. Sale price **$39.95** ea.

30-WATT BOOSTER 30 watt Booster Amplifier. Identical in appearance to the PA-55X above, only with 175 mill power transformer and push-pull parallel 6V6 tubes instead of 6L6's. The same wide range output is incorporated. Use this where 30 watts of ADDED audio power is required. If mike input gain is required order our PR-2X Pre-amp. Stock No. PA-30X. Ship. wt. 22 lbs. Price **$32.95** ea.

2-MIKE PRE-AMP. Pre-amplifier plugs in directly to the PA-55X and PA-30X booster amplifier. It enables use of 2, Crystal or Dynamic Mikes plus one low level input. Furnished with 4 foot cables and plugs for remote control of the 55 or 30 watt Booster Amplifier. Small chassis size 5 x 3¼ x 4". Stock No. PR-2X, with tubes 7F7 and 7N7. Net price **$10.00** ea.

25-WATT HORN 25-Watt Driver and 3½-foot air column re-entrant Trumpet. The standard type trumpet and driver you see the most. Drivers are 100% weatherproof, horn is spun aluminum, offered to you at a considerable savings. Stock No. MA-33. Shipping weight 20 lbs. Net price **$28.95.**

McGEE RADIO COMPANY Prices F.O.B. K.C. Send 25% Deposit with Order, Balance Sent C.O.D. With Parcel Post Orders, Include Postage

TELEPHONE VICTOR 9045. WRITE FOR FLYER 1422 GRAND AVE., KANSAS CITY, MISSOURI

SENSATIONAL NEW 2-BAND RADIO KIT ONLY $14.95

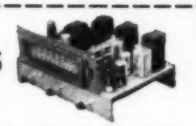
7-TUBE FM-AM TUNER

MODEL RAL-8

$29.95

★ AC SELF POWERED

★ 3 GANG TUNING ★ A COMPLETE KIT



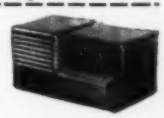
McGee has ready for delivery, this self powered AC, 7 tube FM and AM superhet tuner kit. Build yourself a professional looking tuner that may be connected to any audio amplifier. Receives broadcast 550 to 1650 kc and FM 88 to 108 mc. A 3 gang tuning condenser is used on both FM and AM. This extra stage of TRF makes a smoother working tuner. 2 IF stages on FM and one IF stage on AM (I.F. frequency 456 and 10.7 mc). Lighted slide rule dial with metal escutcheon plate. Our own lab designed and wired an original tuner using these parts. Chassis is ready punched and painted. Everything furnished including tubes and diagrams. Shipping weight 12 lbs. Stock No. RAL-8, net price **$29.95.**

MODEL ME6-2 $14.95

NEW MODEL 6-TUBE, 2-BAND RADIO KIT

A FULL 2-GANG SUPERHET KIT

RECEIVES 550-1600 KC PLUS 6-18 M.C.

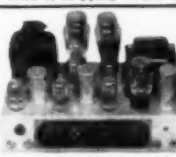


McGee's new 1951, 6 tube; AC-DC 2 band radio kit. Receives broadcast, 550 to 1600 kc and short wave, 6 to 18 mc. A straight forward superhet circuit with 2 gang tuning condenser, 456 kc I.F. transformers, etc. 5" speaker illuminated slide rule dial. Everything furnished, including tubes, diagram and a photo showing view of underside of completely wired chassis. The chassis pan and dial parts are factory production. With this kit, you can build a commercial looking and factory quality 2 band radio, housed in a streamlined plastic cabinet. Size: 13 x 6⅝ x 6¼". Stock No. ME6-2, shipping weight 10 lbs. Net **$14.95.**

SELF POWERED AC Broadcast Tuner Kit. 3-Gang Tuning. Complete Kit, $12.95

A self-powered, 3-gang superhet tuner kit with R.F. stage. When wired according to our diagram will make a top quality broadcast tuner (550 to 1650 kc), for use with any amplifier. Don't class this with ordinary tuners; this has its own power transformer. This complete kit is furnished with a diagram, photos and tubes: 6SH7 R.F., 2–7E5 converter-mixer oscillator, 6SF7 I.F., detector, and 7X4 rectifier. Connect to any audio amplifier. Ideal for use with our S-2020, TM-16 or 7X5 amplifier kits. Chassis size, 9½x8x 4½" high. Shipping weight, 7 lbs. Broadcast tuner kit Model BT-38S. Net price, **$12.95.**

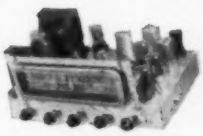
8-TUBE 22 WATT Wide Range Amp. Model 7x5 Kit Only $37.95



A complete kit, including tubes (3-7E5, 2-7F7, 2-6A3, plus rectifier), diagram and photos. All triode circuit makes for minimum harmonic distortion. Inputs for radio tuner any kind of phone pickup (crystal or G.E. variable reluctance) and either crystal or dynamic mike. Output transformer matches 8 ohm voice coil. Twin electronic tone controls, bass and treble with range selector switch for either juke box quality or brilliant symphonic range. The best quality amplifier kit we know how to make. Has a very wide range output and heavy power transformer. Response 18 to 20,000 CPS. 8 tube all triode amplifier kit, complete with tubes. Weight 25 lbs. Net **$37.95.**

10-TUBE RADIO KIT $29.95

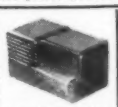
3-GANG TUNING
MIKE INPUT
12 WATT
HI-FI AUDIO
BASE-TREBLE BOOST



A NEW 1951 ALL-PURPOSE RADIO KIT

10-Tube Broadcast (550 to 1700 kc) Radio Kit for custom builders. Features 3-gang superhet circuit with A.V.C., high gain IF circuit, 8" slide rule dial. Chassis size 12½" long, 10" front to back, 6½" high. Audio inputs for a crystal or dynamic mike, and record changer or player. Tone compensation for standard crystal pick-up or General Electric variable reluctance. Push-pull 6V6 output tubes, shielded high fidelity output transformer matches 8 ohm PM speaker, husky power transformer, 2 tone controls for separate base and treble boost. A complete kit, including tubes (3—7E5, 6SH7, 6SF7, 2—7F7, 2—6V6, plus rectifier), diagram and instructions. Shipping weight 18 lbs. Stock No. BK-R10. Net price **$29.95.** 10" PM speaker, **$6.95** extra. Crystal mike and desk stand, **$4.95** extra. VM-406 3-speed automatic record changer, **$22.95** extra.

5-Tube Broadcast SUPERHET RADIO KIT $12.95

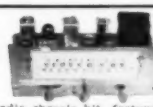


Model RS-5 tube AC-DC superheterodyne radio kit. Has loop antenna and 2 gang condenser, with lighted slide rule dial and attractive plastic cabinet. Receives broadcast, 550 to 1650 kc. Full size dynamic speaker, matched 456 I.F.'s, automatic volume control. This is a complete radio kit. Everything furnished, including diagram, photos and tubes: 12K8, 12SH7, 2—7E5 and 70L7. Shipping weight 7 lbs. Stock No. RS-5. Net price **$12.95.**

Build Your Own Phono-Mike Broadcaster $7.95

Kit Model DE-6R. With this simple kit, you can build a 3-tube phono oscillator that also has a mike input. Will broadcast over any radio, within your home, about 75 feet from 800 to 1500 kc. Inputs for crystal mike or crystal phono pickup. Fader control fades from mike to record. Ideal for a home P.A. system, baby listener and home entertainment. A complete kit of parts including tubes. Kit Model DE-6R. Net price, **$7.95.** DE-6RWT, wired and tested. Net price, **$9.95.** Crystal mike and desk stand, **$4.95** extra. Concealed microphone unit, only 1" in diameter and ¼" thick. Specify hidden mike when ordering. Stock No, T-001. Net, **$3.95** extra.

6-TUBE AC-2-BAND KIT $16.65



A New 2-band radio chassis kit, features 3-gang tuning, full AC circuit with power transformer, complete with diagram, all parts and tubes, 7H8, 2 7A7, 7B6, 6K6, and 5Y3. Chassis size, 7" deep, 6" high, 12½" long, 7½" slide rule dial. Very ideal for schools, etc. A straight forward superhet circuit complete except for speaker and cabinet. Output transformer is part of radio kit. Stock No. AA-93 Shipping weight 9½ lbs. Net price **$16.95.** 6" PM speaker **$2.79** extra. 8" PM **$3.49** extra.

5-STATION INTERCOM MASTERS $16.95

SUB-STATIONS $3.95

Model 2700 5-station intercom master, in an attractive walnut cabinet 10⅝x12x6". Push-button talk and talk-listen switch and volume control. AC-DC amplifier with lots of power and full size Alnico V PM speaker. 1950 production of a famous factory. Only 300 left, weight 7 lbs. Model 2700, net, **$16.95.**

Model MG-300 molded walnut plastic substation with call-back switch and heavy PM speaker, 5¼x8½x3½", for wall or desk. Weight 2 lbs. Net, **$3.95** each; 5 for **$18.95.**

3 wire intercom cable, plastic, **$1.95** per 100 ft.; 500 ft., **$9.50.**

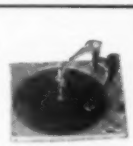
4-PRONG VIBRATORS $1.29

IN ALUMINUM SERRATED CANS

10 FOR $11.90

4 MILLION AUTO RADIOS BUILT IN 1950 AND HERE IS THE PERFECT REPLACEMENT VIBRATOR FOR MOST OF THEM.

Latest 1951 production by a top quality manufacturer. Fully guaranteed six months. Quiet running. A result of modern vibrator engineering and research. Replaces Motorola, Chrysler and any standard 4 prong non-sync vibrator. McGee contracts for a tremendous quantity to take care of your 1951 needs. Stock # V-53 Standard 4 Prong Vibrator **$1.29** each. 10 for **$11.90**; 50 for **$55.00.**



RED HOT VALUE

3-SPEED WEBSTER CHICAGO CHANGER $24.95

WHY PAY MORE?

Webster Chicago Model 100-16 3 speed automatic record changer with crystal cartridge and all speed Sapphire needle. (1 needle plays all records). Base size 12⅞". Shipping weight 14 lbs. This offer good only as long as our stock lasts. A special purchase makes this offer possible. Webster Chicago 3 speed changer, Model 100-16. Sale price **$24.95.**

NEW HEAVY DUTY 4-PRONG VIBRATOR $1.95

For 7-8 Tube Auto Sets $1.95

A standard 4 prong vibrator that lists for $4.90 costs service men $2.94. But, you can buy this 8 prong heavy duty vibrator at Mcgee for only $1.95 each, or 10 for $17.50. If you have had trouble with vibrators that don't hold up in the 7 and 8 tube original equipment auto radios, this is the vibrator that you should buy. Vibrator can is standard diameter and length. Fits Mopar, Chrysler, etc. Unit is a heavy duty, 8 point, non-sync type; especially designed for auto sets that draw more than 60 mils 'B', such as 7 and 8 tube sets with push-pull 6V6's, 6K6's, etc. A long life vibrator offered to you at a saving. Fully guaranteed for 6 months. Stock No, V-90, **$1.95** each, 10 for **$17.50.**

5 OZ4 TUBE & 5 VIB. DEAL No. RN-V5 ..... $9.50

Here's a red hot deal for you fellows that do a lot of auto radio service. 5 standard brand metal OZ4 tubes and 5 of our famous 4-prong serrated can vibrators. This vibrator is of the latest design, for long life. Standard diameter can, short enough to fit all Chrysler auto sets, also fits Motorola, etc. Our 20th Anniversary, big deal No. RN-V5. You can get 5 OZ4 metal tubes and 5 4-prong vibrators, all for **$9.50.** Shipping weight 3 lbs.

10 OZ4 TUBES—$5.95

This month only, 10 1951 Production OZ4 metal tubes, standard brand. Radio News deal No. 24-RD. Net price **$5.95.** 10 deals, 100 tubes **$55.00.**

12" 32 OZ. PM. SPEAKER $7.95

12", 32 oz. magnet, 20 watt PM speaker, with 8 ohm voice coil. A regular $17.00 list Consolidated speaker. Weight 8 lbs. No. CN-1232. $7.95 each, 4 for **$29.95.**

50-W. OUTPUT TRANS. ONLY $7.50

WHY PAY MORE

50-watt super quality high fidelity output transformer. Matches push-pull parallel or push-pull 6L6 tubes to 4/8/16-ohm voice coil, also 60 and 250 ohm line. Very efficient winding construction only 140 ohms, total resistance in primary, and 8-ohm voice coil tap only .2 of an ohm. This output transformer wastes a minimum amount of audio power due to heat loss within the transformer. Very ideal for only amps. Stock No. 50-JB, net weight 5½ lbs. Bargain price **$7.50** ea., 2 for **$13.95.**

McGee's Super High Fidelity Best Value in U.S.A.

OUTPUT TRANS. $7.95

20-20,000 CPS.

Model A-403 High fidelity output transformer. Why pay $20 or $30 for an output, when our A-403 is available at $7.95? Impedance, 6600 ohms plate to plate. (for PP 6L6 or 6V6), 105% feedback winding, 4-8-15-250 and 500 ohm secondary. Housed in a potted case. Net weight 6 lbs. Recommended for all amplifiers up to 34 watts.

TREMENDOUS SALE ON AUTOMATIC CHANGERS

GENERAL INSTRUMENT

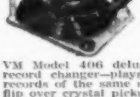
78 R.P.M.

Record Changer

SCOOP PRICE $10.95

TWO FOR $21.00

General Instrument 78 RPM automatic record changer. Plays 10- or 12-inch records automatically. One of the latest models made. Beautiful golden brown hammertone finished base, 12x12⅞"; Equipped with an Astatic L-70 crystal cartridge. Heavily flocked turntable and plastic fittings are deep maroon colored. This may be our last chance to offer a 78 RPM changer at this price. Comes packed two to a master carton, just like they would be shipped to a set manufacturer. Order 2 changers for an additional saving. Shipping weight for 2 changers, 20 lbs. Stock No. IT-80I. Net price, **$10.95** each; two for only **$21.00.**



V.M. 3 SPEED Record Changers $22.95

VM Model 406 deluxe 3 speed automatic record changer—plays them all—intermixes records of the same speed—equipped with a flip over crystal pickup with twin needles—base size 12⅛x15⅜. Ship. weight 12 lbs. VM-406. Net, **$22.95.**

Buy the VM-950 changer with or without base. Choice of G.E. VR or crystal cartridge. We think the VM-950 record changer is the finest in America. It automatically plays all records all speeds and all sizes; 12 10-in., 33⅓ or 78 rpm, 10 12-in., 33⅓ or 78 rpm and 12 and 10-in. records of the same speed intermixed, 12 7-in. 33⅓ or 12 7-in. 45 rpm. Automatically shuts off after the last record. Size 13 13/16x11⅞x7¼ in. high. Offered with crystal cartridge, G.E. VR cartridge, or either with a base. VM-950, 3 speed changer with standard crystal cartridge and needles for 1 and 3 mil, (78 rpm, 33⅓ & 45 rpm). Net **$29.62.** VM-950GE, 3 speed changer with the new RPX-050 magic, all-in-one variable reluctance cartridge with stylus. Net **$32.80.** VM-955, 3 speed changer with crystal cartridge on a base. Net **$32.01.** VM-955GE, 3 speed changer with RPX-050 VR cartridge with base. Net **$35.19.**

SUPER HEAVY DUTY 10" PM $6.95

We made a special purchase on several hundred 20 watt, 10", 32 oz. Alnico 3 magnet PM speakers. Deep throat and easy moving cone. Ideal for all high fidelity sound systems and radio replacement. The magnet on this speaker is usually used on a 15" size. Very efficient, good high and bass response. You'll appreciate it when you get your hands on this speaker. Attractive copper finish. 8 ohm voice coil, Stock No. 1025PS. Weight 7 lbs. Net price **$6.95** each.

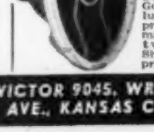
Order three of these and use them in a cluster of three. They will take 60 watts of audio and have more cone area than any 15" speaker. For high power, top quality P.A. work. Think this over. 3 No. 1025PS speakers for only **$19.95.**

BUY YOUR WIDE RANGE COAXIAL SPEAKER AT McGEE

12" COAXIAL PM $12.95

A $32.50 retail value, 20 watt 12" coaxial PM speaker of quality used on radios of the $300 to $500 bracket. Hook up like any PM speaker. High pass filter is built on speaker. Matches 8 ohm output of radio or amplifier. Wide range response, 20 to 17,500 CPS. Model No. CU-14X. Ship. wt. 9 lbs. Special sale price. **$12.95.**

15" COAXIAL PM $19.95



Only $19.95 buys a full 15", 20 watt coaxial PM speaker, with built-in high pass filter. Hook to any 8 ohm output on radio or amplifier. Response below 20 to above 17,500 CPS. Good bass response. A lucky purchase makes this price possible. Full 32 oz. magnet in the woofer. 5" tweeter. Model P15-9. Ship. wt. 11 lbs. Sale price. **$19.95.**

McGEE RADIO COMPANY Prices F.O.B. K.C. Send 25% Deposit with Order. Balance Sent C.O.D. With Parcel Post Orders. Include Postage

TELEPHONE VICTOR 9045. WRITE FOR FLYER
1422 GRAND AVE., KANSAS CITY, MISSOURI

Unusual Transmitter

(*Continued from page* 55)

Then in position 3 connect the microphone and modulate the transmitter. While listening to the signal adjust R_{11} (near the center of its range) for the cleanest modulation. R_9 controls the sensitivity of the modulated amplifiers. With all of the resistance in the circuit the most sensitive point is reached.

The drawings in Fig. 6 were copied from oscilloscope pictures of the signal and show some of the various patterns that are possible.

An oscilloscope is not required for adjusting this transmitter, but reasonably accurate peaking of all stages is necessary for proper operation and 100% upward amplitude modulation.

Listening to the signal before all r.f. tuning is completed can be very deceptive as the outputs of all the low level stages will be heard in the receiver at once. For instance, when only one 2E26 is functioning the signal will still appear to be AM because this signal is combined in the input of the receiver with that of the opposite 6AK6 output.

Overmodulation in the conventional sense seems to be impossible, as once the output reaches the combined outputs of both final tubes further increase in modulation causes a decrease in output. Severe negative cut-off with modulation is impossible too, as when the phases are in excess of 180° apart the outputs become additive again. Excessive modulation is not recommended, however, as a 45° shift from each modulator is expecting enough and audio distortion might result if this shift is increased much beyond this point.

The system of modulation used in this transmitter is in widespread use among European broadcasting stations, and should be of interest to serious minded amateurs.

W9MWD is active with this transmitter on the low end of 75 should anyone care to hear it before trying out this system of modulation. —30—

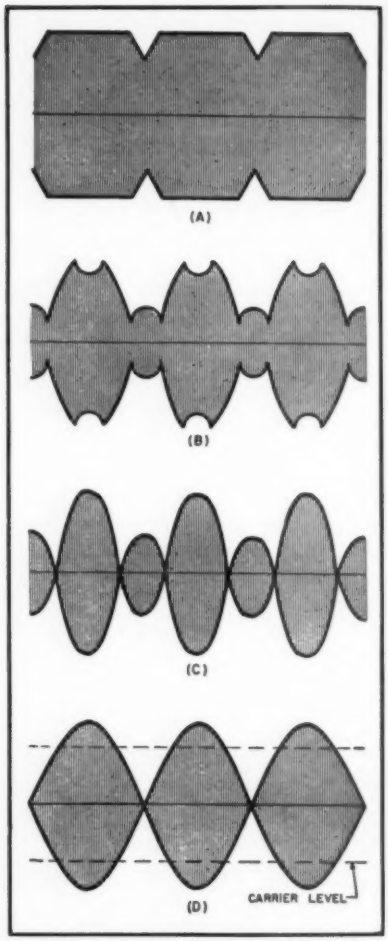
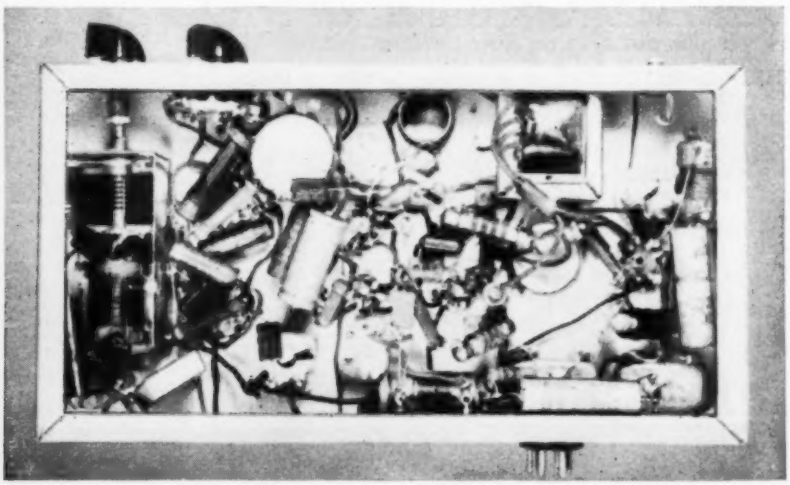
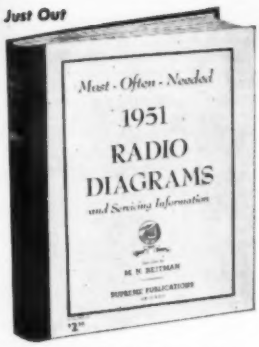


Fig. 6. Various scope patterns obtainable with this unit. (A) Clipping due to excessive phase change in 90-degree phase shift circuit. (B) Transmitter adjusted properly but overmodulated. (C) A phase change in excess of 90 degrees in final amplifiers. (D) 100 per-cent modulation with all of the stages properly tuned.

Under chassis view of the W9MWD transmitter which is built on 7x13x2-inch chassis.



Just Out



New SUPREME 1951 Radio Manual

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SERVICE MATERIAL ON THESE MAKES:
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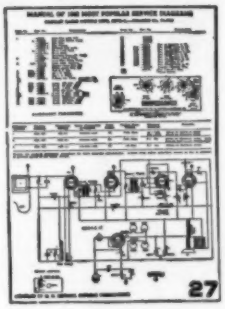

A typical page from any **Supreme Publications** Radio or TV Manual is extra large in size (8½x11 inches), and is well printed on heavy, 60-pound paper. It contains a complete schematic diagram, easy-to-follow instructions for alignment, voltage comparison charts, parts lists, and other facts needed for fast trouble-shooting and simplified repairs. **Supreme Publications** give more useful on-the-job information for the lowest cost.

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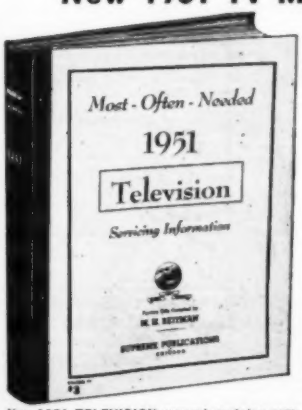
New 1951 TV Manual, *Just Out*



New **1951 TELEVISION** manual contains complete service data on all popular present-day television sets of all makes. Gives description of modern circuits, test patterns, response curves, oscilloscope waveforms, alignment tables, service hints, diagrams in the form of double-spread blueprints, test points, voltage charts, etc. Large size: 8½x11 in., manual style binding, flexible covers, at your jobber or by mail, only..... **$3**

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HOW MANY OF THESE BARGAINS DO YOU NEED?

ALLIANCE TENNA-ROTORS

The Alliance Tenna-Rotor makes it possible for you to "beam" or turn your antenna in the direction best suited to pick up any TV station within ranges. When so turned the signal delivered by the antenna to the TV set is increased by giving you a better, clearer picture. The rotator unit is fully enclosed in a moisture-proof housing, factory lubricated for life. Bearings are stainless steel. Works in any weather. Guaranteed for a full year. Approved by Underwriters' Laboratories. Can be used on all masts up to 1⅝" diameter. Takes up to a 20 lb. antenna. For heavier antennas also order the Thrust Bearing Bracket shown below. Operates on 115 V. 60 cy AC 30 watts. Rotates clockwise or counter-clockwise full 360° at 1 RPM. **Available in 3 models.**

AU-15. MODEL ATR. Tenna-Rotor with control box which shows end of 360° rotation by means of an indicator lamp on control box. Does not show direction of antenna. Each..... **$20.53**

AU-12. MODEL DIR. Tenna-Rotor with control box which employs an indicator dial showing direction antenna is beamed, ea. **26.43**

AU-21. MODEL HIR. Tenna-Rotor with automatic control box. You set the pointer for direction desired and antenna turns to that direction and stops automatically. Each..... **$26.43**

4 CONDUCTOR CABLE

For use with all Alliance Tenna-Rotors.
W-62. 100 ft. Coil, ea.... **$4.00**

THRUST BEARING BRACKET

For use with any above Alliance Tenna-Rotors where extremely heavy antenna is to be used. Supports up to 200 lbs. **AU-13,** each....**$2.91**

ORDER TV PARTS FROM OLSON

EM-PM FOCUS COIL

T-90 Special. While they last, each.... **$2.98**

Latest style combination EM-PM type requiring less power than the straight EM coils. Uses a very heavy Alnico 5 magnet thereby maintaining a more constant focus. This focus coil is used in scores of TV sets including General Electric, Stromberg-Carlsen, Air King and many more. Can be used on all 16"-70° and 19"-66° Kinescopes. Here's a real value. Buy now and save. **Because of the shortage of Cobalt these will not be available after our present stock is gone.**

ION TRAP

T-91 Special. While they last, each.... **98¢**

Well made ion trap with two powerful Alnico 5 magnets. Exceptionally well made. Bronze spring keeps trap firmly against kinescope neck. **Because of the shortage of Cobalt these will not be available after our present stock is gone.**

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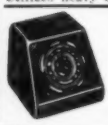
T-89 Special. While they last, each.... **$1.98**

Genuine focalizers, also known as focus magnets. Provides sharp focus relatively independent of regulation in the low voltage power supply. No connections necessary. Widely used in many 1950 models. Utilizes heavy duty Alnico 5 magnet.

ALLIANCE TV BOOSTER



Alliance Booster offers electronic features in design for maximum reception in fringe TV areas. Gives the signal a real boost. One control for all channels. Automatic switch turns Booster on with set. Shpg. wt. 7 lbs.
RA-62...... **$17.97**

NEW 70° TV PARTS—LESS THAN MFG. COST

Positively the hottest bargain Olson ever had. You need these parts for change-over to big pictures as well as for repair jobs.

Univ. GE Type Flyback RTO-085 (77J1)

LOTS OF TEN. **$3.49** ea.

Universal GE type high voltage transformer. Lists at $11.50. New ferrite type. Delivers 14,000 volts full 65° to 70° horizontal scan for kinescopes up to 24". Size 2⅝"x2"x4".
T-94. Single, each....**$3.99**

70° DEFLECTION YOKE

LOTS OF TEN. **$2.99** ea.

Replacement for RCA 206D1. Powdered iron ferrite Yoke gives sharp, clear pictures. Can be used on all kinescopes up to 24". Fully equipped with resistors and 50 mfd. condensers and long leads. Lists at $9.00.
T-93. Single, each....**$3.49**

Deflection Yoke for use with 10BP4, 12LP4, 16AP4 and all similar kinescopes, same RCA 205D1. WT. 2 2.
T-84. Ea. **$2.79.** Lots of 3.....**$2.29** ea.

300-Ohm Lead-in

$3.33 Ea., Lots of 10

High grade, low loss. For all TV installations. Ship. wt. 3 lbs.
W-68. 100 ft. coil. Each **$4.00**

$2.29

Hi-Voltage Flyback output transformer for 10" & 12" kinescopes. Provides 9KV. Same as RCA 211T1. WT. 4 2.
Lots of 3 each **only**.....**$2.99**
T-82. Olson's Price!

PICKUP ARM

With crystal cartridge. Plays all 78 RPM records.
M-58 Each **$2.99**

3 SPEED PICK-UP ARM

Cartridge flips by means of a lever. Equipped with dual cartridge, one side plays 33⅓ and 45 and other 78 RPM. Double needle included.
M-64 Each **$4.95**

SPRAGUE TV FILTERS

20-10-10-10 MFD—450 V

This is it. A four-section Twist-Prong volt electrolytic condenser that will operate up to temperatures of 185° F. Widely used in TV sets, amplifiers and radios. Will withstand high ripple and voltage surges. Size 1⅝"x2".
C-617. While they last, ea....**99¢**

TV Antennas

Here is a real bargain for TV installation men. Genuine Conical TV Antennas scientifically designed to give optimum reception. Highest grade aluminum tubing is used. Complete with antenna members, reflector elements, cross arm and cross arm brackets. Less mast and 300 ohm twin-lead line. Take any size masts up to 1⅝" O.D. Packed in factory sealed cartons of 6 Antennas to a box.

SOLD ONLY IN BOXES OF 6 ANTENNAS

AU-62. In lots of 6, each **$3.83**

Carton of 6, wt. 25 lbs.. **$22.98**

TV INSTALLATION MEN

If you install TV Antennas, Olson wants you to take advantage of this terrific Antenna Value. High gain Stacked Conical Array with high frequency stubs. Ideal for "Fringe" Area Reception. Sturdily constructed, elements are aluminum. Easily assembled.

THIS IS A TERRIFIC VALUE!

Each Antenna consists of two conical bays plus a pair of matching Q bars. Less mast. Packed—3 Antennas to a carton. This gives you six bays and 3 pairs of Q bars.

Sold Only in Boxes of 3 Antennas

AU-66. In lots of 3, each..... **$8.66**

Carton of 3..... **$25.98** Weight 25 lbs.

RCA 8" PM SPEAKER

S-123 **$2.99 EACH**

Known as the RCA "Mighty 8." Delivers tremendous volume because of advanced engineering design and super-size Alnico 5 magnet. For radio and PA use. Voice coil 3.2 ohms. Shpg. wt. 6 lbs.

OLSON'S BIG BARGAIN SPEAKERS

Genuine Alnico 5 PM Speakers

Stock No.	Size	Watts	lbs.	Each
S-4	4"	3	2	$1.69
S-5	5"	3	2	1.79
S-85	5"	5	2½	2.19
S-7	6"	5	2½	2.29
S-102	6"-8"	6½	3	2.69
S-114	6x9"	9	4	3.39
S-96	7"	6	3	3.39
S-86	8"	7	4	3.49
S-111	12"	10	5	5.95
S-112	12"	13	6	6.95

Because of the shortage of Cobalt used in Alnico 5 powerful magnets these speakers will not be available after our stock is gone. Protect yourself—Order now—Order enough. These speakers are made by a nationally famous manufacturer and are guaranteed to give 100% satisfaction. Frequency response is excellent. All speakers have 3.2 ohm voice coils except 12" which are 6-8 ohm.

$13.95

S-160

Woofer-Tweeter design. Response 40 to 17,500 CPS

12" CO-AXIAL SPEAKER

Months of research went into the design of these high efficiency speakers. The 12" woofer section is driven by a heavy Alnico 5 6.8 oz. magnet and this part delivers the bass notes. The 3" tweeter which is built into the center of the speaker is driven by a 2.15 oz. Alnico 5 magnet and delivers the treble notes. The high pass filter is built into the speaker and the entire combination gives you tone you never dreamed possible. There are only two wires to connect to any radio or amplifier and the speaker is ready to play for you. Voice coil impedance is 8 ohms. This high quality speaker should not be confused with inferior makeshift units. Olson sells these speakers on an ironclad moneyback guarantee if you are not 100% satisfied. Order today. Shpg. wt. 8 lbs.

AMAZING RECORD PLAYER DEAL

***AT LESS THAN THE COST OF THE PARTS**

$19.97 RA-60

Your Special Price At Olson's

Here is a once-a-year special. In this deal you get a nationally famous 78 RPM Record Player and $10.00 worth of genuine RCA Victor non-breakable children's records. You couldn't buy the parts alone at this price.

***Look what the parts would cost if bought separately even at our SPECIAL SALE PRICE.**

78 RPM Motor	$ 3.79
Phono arm and cartridge	2.99
Amplifier	3.98
Set of tubes for amplifier	1.89
PM Speaker	1.69
Output Transformer	.69
AC Cord	.29
Decorated Case	4.99
Set of RCA Victor Non-Breakable Records	10.00
	$30.31

And best of all—this is not a kit. The phonograph comes to you completely assembled and factory tested. No troublesome wiring. No mistakes. Just plug in—put on the RCA non-breakable records which you get with the outfit and you have dependable entertainment. The amplifier employs 2 tubes, a 50L6 and a 35Z5. Motor is Alliance, the finest. The crystal tone arm is made by Astatic, Shure and Electro-Voice. In addition you get a complete set of RCA Victor non-breakable Children's Records which include such favorites as "Happy the Humburg," "The 500 Hats of Bartholomew Cubbins," "Rapunzel," "Aladdin and His Lamp," etc. Discs are enclosed in beautifully colored albums giving each story so that the child can follow the recording.

The cabinet is decorated with gay circus figures and the volume can be easily regulated by the full range volume control. Operates on 115 volts AC. Shpg. wt. 15 lbs.

Don't delay, order several now. The price is low enough so it pays to order even for the parts contained.

NO MORE WHEN THESE ARE GONE

3-SPEED RECORD PLAYER

***AT LESS THAN THE COST OF THE PARTS**

$19.97

YOUR SPECIAL PRICE FROM OLSON'S Model RA-56

While they last Olson offers these high quality 3-speed record players at less than the cost of building one. The players were made for a nationally famous store and Olson was able to get one thousand to move at this fantastically low price.

***Look what the parts would cost if bought separately even at our SPECIAL SALE PRICE.**

3 Speed Motor	$ 5.99
3 Speed Phono Arm	4.95
Osmium Tipped Needle	.69
Amplifier	3.98
Set of Tubes for Amplifier	2.10
PM Speaker	1.69
Output Transformer	.69
Set of Knobs	.24
AC Cord	.29
Portable Case with Cover	5.49
Total	$26.11

Remember, this is not a kit, but a completely assembled 3-speed record player with built-in 2-tube amplifier and speaker, housed in a beautiful carrying case. Plays all 33⅓, 45 and 78 RPM records up to 12" diameter. Motors are made by Alliance and the finely balanced low pressure tone arms are supplied by Astatic, Shure and Electro-Voice. Every phonograph is 100% guaranteed. Original factory-sealed carton. Operates on 115 volts AC. Shpg. wt. 15 lbs. Don't delay, order several now. The price is low enough so it pays to order even for the parts contained.

NO MORE WHEN THESE ARE GONE

4 PRONG VIBRATOR. Popular 4 prong vibrators as used in 90% of auto sets. We promised not to mention the manufacturer's name. Save more than 70%. Guaranteed. Replaces Motorola, Chrysler and any standard 4 prong non-sym. vibrator. Replaces Mallory 294, 859, 901M; Radiart 5300, 5301. Can size 1½"x2⅞". Reg. List Price $4.80.
V848 Single, Each **$1.49**
Lots of 10, each **$1.29**

AUTO RADIO ANTENNAS

RUSTPROOF BRASS TUBING! INSTANTLY ADJUSTED! DURABLE SIDE COWL MOUNT

3 section; extends to 66". Includes low loss lead-in cable.

$1.99 AU-1

TRIPLE CHROME PLATED HIGHEST QUALITY INSULATORS! TOP COWL MOUNT

3 section; extends to 54". Includes low loss lead-in cable.

$2.99 AU-8

GENERATOR CONDENSERS

For all auto sets. Single, each..29¢
C-220, Lots of 10, each..**25¢**

PHILCO 1951 AUTO RADIO— THE ONLY UNIVERSAL ONE-PIECE AUTO RADIO FOR ALL CARS

FITS ANY CAR OLD OR NEW

A brand new Philco 6-tube super-het auto set with 30% more undistorted sound output for rich, clear-voiced volume and greater range. New 3-gang permeability tuner. Built-in interference filtering.

New streamlined design, with slide-rule dial encased in gleaming chrome finish to harmonize with modern cars. Rugged, compact steel case finished in dark blue hammertype lacquer, has sloping front—neat, attractive, space-saving—out of passengers' way. Installed in a few minutes beneath the instrument panel of the car. Controls are easy to reach and tune . . . yet set is out of the way and virtually out of sight like a built-in part of the car. Complete with tubes, mounting bracket, generator condenser and distributor suppressor. Size: 5¾"x 5⅜"x7¼". Shpg. wt. 20 lbs.

Model CR-501

$34.37 OLSON'S GREAT VALUE!

OLSON RADIO WAREHOUSE • 73 E. Mill St., Akron 8, Ohio

TO SAVE MONEY — ORDER FROM OLSON RADIO

RECORDING TAPE AT LESS THAN MFG. COST

A top-notch RECORDING TAPE manufacturer wanted to dispose of a solid truck load of fine quality high grade tape and naturally he chose Olson for the the deal. Now you can get your share at less than jobber cost. Our price laughs at competition. Get your supply while we have it. Excellent frequency response, 50 to 8000 cycles. Standard 1/4" wide. Plastic reel included. Can be used on any tape recorder. Choice of sturdy paper or plastic base.

X-248 PAPER BASE 1200 Ft. Reel included. Single, ea. $1.69. **LOTS OF TEN, ea. $1.49**

X-249 PLASTIC BASE 1200 Ft. Reel included. Single, ea. $2.19. **LOTS OF TEN, ea. $1.99**

MAY BE ASSORTED FOR 10 LOT PRICE

STEEL RECORDING WIRE

For all standard wire recorders. Frequency response is excellent. Stainless steel wire.

X-165 1/2 hr. spool..... $1.98

X-166 1 hr. spool..... $2.98

PHONO CARTRIDGES

A truly universal type. A perfect replacement for Astatic L-70, L-72, L-82, L-40, etc. Delivers 3 volts output. Brand new, fresh stock. Order plenty during this sale.

XC-30. Single, ea. $1.79. Lots of 10, ea..... $1.59

HIGH OUTPUT CARTRIDGE

Similar to above but will deliver 6 volts. Can be used on all speed discs, 33⅓, 45, and 78 RPM.

XC-47. Single, ea. $2.19. Lots of 10, ea..... $1.99

NEW CRYSTAL MIKE

Olson's Special $4.29 M-71

Nationally famous make. Smart New Design, easy to hold. Used in many tape, wire and disc recorders. Can be used on P. A. systems, amplifiers, etc.

Build a Receiver Set of Basic Components AS-38

Kit of 5 parts... $1.89

You get this kit of 5 basic parts to build an AC-DC set or portable:

Parts	Reg. List Price
Loop	$0.95
R. F. Coil	1.10
I.F. Transformer (456 Kc. Input	1.60
Output	1.60
Oscillator Coil	.75
List Price of Set	6.00

Use any 365 mfd variable for tuning. Covers 535-1625 KC.

MICROPHONE

High output crystal mike for PA systems and recorders. Equipped with handle base and 7' shielded cable. Shpg. wt.—5 lbs.

M-67, each, $5.95

M-66, same but with on-off switch built into handle..... $6.95

OUTPUT TRANSF. T-21

69¢

Most popular transformer in use today. Matches 50L6, 35L6, 25L6, etc. Primary 2000 ohms. Secondary matches any 3.2 ohm voice coil speaker. Regular list price is $1.75. Size 1⅞"x 1¼". Shpg. wt. 1 lb.

TUBULAR ELECTROLYTICS

All standard types. Most popular sizes. Aluminum tube with cardboard insulating sleeve. Olson was Johnny-on-the-Spot and he got a bargain—you can cash in. Every condenser unconditionally guaranteed a full year.

20 MFD. 150 V	40 MFD. 150 V	50-30 MFD. 150 V
STOCK No. C-628	STOCK No. C-629	STOCK NO. C-630
25c	27c	49c
8 MFD. 450 V	**20 MFD. 450 V**	**40 MFD. 450 V**
STOCK NO. C-631	STOCK NO. C-632	STOCK NO. C-633
33c	40c	45c

RIM DRIVE PHONO MOTORS

Real bargains. Self-starting; complete with turntable. All parts included. Shpg. wt. 4 lbs.

M-52. 78 rpm for 115 volts AC..... $3.79

M-63. 3-speed, 33⅓, 45 and 78 rmp..... $5.99

PHONO AMPLIFIER RA-19

$3.98

Connect to phono or speaker or just the thing for a portable. Uses: 12SQ7, 50L6, 35Z5 tubes. 2 controls: on-off volume and tone. 7"x3¼"x2". Shpg. wt. 2 lbs. TUBES FOR ABOVE SET: AS-22..... $2.64

FREE SEND FOR OUR LATEST RADIO AND TELEVISION BARGAIN CATALOG

OLSON'S NEW AKRAD KIT —WITH 4-DRAWER STEEL CABINET FREE

Reg. List Price $18.38. AS-36

$6.95

We have a limited quantity of Olson Akrad "Super Sealed" by-pass condensers available in 4 drawer steel cabinets, size 6¼x5¾x8⅛. Drawers have compartments. Condensers are designed to give long dependable service even in the tropics. **Kit Contains 42 Condensers.** You get the 4 drawer steel cabinet and the following 42 Olson Akrad "Super Sealed" by-pass condensers.

Qty.	Cap.	Volts	Qty.	Cap.	Volts
2	.001	600	10	.05	600
2	.002	600	10	.1	600
2	.005	600	2	.005	1600
5	.01	600	2	.008	1600
5	.02	600	2	.01	1600

PANEL LAMPS

Westinghouse, GE, and Tung-Sol bayonet panel lamps. 100 of a type to the box.

Stock No.	Type No.	Price per 100
X-161	47	$5.59
X-174	44	
PL-25	51	$4.29

NOTICE RADIO MANUFACTURERS

• Olson Radio has established a tremendous market among radio servicemen, amateurs, universities and industrials all over America as well as principal foreign countries. Our famous rapid mailing service is the talk of the trade.

If you have any good, clean surplus radio material which you wish to dispose of, contact Olson at once. We can use: radios, amplifiers condensers, chassis, phono motors, pickup arms, volume controls, test equipment, speakers, in fact any radio or electronic part or piece of equipment.

Here is your opportunity to turn idle inventory into cash. Write, wire or call Olson, the popular name in radio.

10-WATT RESISTOR KIT

RK-2 $4.95

All wire wound resistors, 10 watt, fully insulated. Long leads. You get 20 resistors ranging from 25 ohms to 25,000 ohms.

FP CONDENSER KIT

AS-24, each $3.98

Assortment of 15 popular FP condensers, double and triple sections. Capacities from 10 mfd to 50 mfd; from 25 to 450 volts. Shpg. wt. 3 lbs.

HOOK-UP WIRE KIT

$4.95 AS-19 500 FT.

How can we give you so much high grade wire for so little? Olson bought all the wire in sight and is passing the bargain on to you. Kit contains 5 rolls, each 100 ft.—total 500 ft. Various colors, push back, plastic and rubber insulation; solid and stranded copper. Shpg. wt. 3 lbs.

CLEVELAND, OHIO
2020 Euclid Ave.
If you live in or near Cleveland visit our store, get these and many more bargains.

CHICAGO, ILLINOIS
623 W. Randolph Street
If you live in or near Chicago visit our store, get these and many more bargains.

MAIL ORDERS SHOULD BE SENT TO AKRON, OHIO

RADIO TUBES BELOW COST!

Olson bought tremendous tube inventories from THREE GOOD SIZED DEALERS who were overstocked. Now we offer them only WHILE THEY LAST at far below regular dealers costs. Check over this list carefully. Every tube type in popular. Order some of each. All tubes are individually boxed. Brands include Ken-Rad, Tung-Sol, Philco, Sylvania, Raytheon, etc. Every tube brand new fresh stock. 100% guaranteed by the manufacturer and Olson. You can't lose. ORDER TODAY.

5U4G ...ea. 74c | **6SN7 ...ea. 99c**

YOUR CHOICE 5Y3GT, 6J5, 6N7GT — **59¢ EACH**

YOUR CHOICE 0Z4, 6AR5, 6AV6, 6SH7, 35Z5 — **69¢ EACH**

YOUR CHOICE 1U5, 6AL5, 6AU6, 6BA6, 6K6GT, 6S4, 6W4GT, 12SK7, 12SQ7 — **79¢ EACH**

YOUR CHOICE 1B3GT, 1X2, 12AU7 — **$1.19 EACH**

6BG6G ..ea. $2.19	6V6GT ....ea. 89c
6CD6 ....ea. $2.79	7N7 .....ea. 99c
6K7GT ....ea. 99c	25W4GT ..ea. 89c

IT'S EASY TO ORDER FROM OLSON'S

How to order: Order directly from this ad. For convenience use this order blank. Fill in columns below with quantity desired, stock number, description and price. You may send remittance with order (include enough for postage or parcel post shipment), or if you prefer SEND NO MONEY. Olson will ship C.O.D. and you may pay mail or expressman for merchandise and postage.

MONEY BACK GUARANTEE: *Everything you order from Olson is guaranteed as advertised. If you are not more than satisfied, you may return merchandise for cash refund.*

Please Minimum Order $3.00

QUANTITY	STOCK NUMBER	DESCRIPTION	PRICE EACH	TOTAL

NAME _____ TOTAL

ADDRESS _____ ADD POSTAGE

CITY _____ ZONE ____ STATE ____ TOTAL AMOUNT

RN851

OLSON RADIO WAREHOUSE • 73 E. Mill St., Akron 8, Ohio

TV Pictures in Color

(*Continued from page 40*)

to the scanning lines as it moves down the screen. In order to accomplish this, it is necessary for the filter segments to be distorted, like those shown in Fig. 3, because the scanning raster is rectangular and the filters revolve. These segments are distorted in such a manner that it is impossible for any line or group of lines to be observed through the wrong filter.

A typical color disc assembly, with a manually synchronized motor, is shown in Fig. 3. As with all rotating discs it is intended to be used directly in front of the picture tube. In this instance, the maximum diameter of the disc will depend on the picture tube being used. It is possible, however, as an experimental procedure only, by pulling the disc away from the picture tube, i.e., closer to the viewer, to use the same size disc with a larger picture tube. Thus, by reducing the distance between the viewer and the rotating disc and increasing the distance between the disc and the picture tube, a 12" color disc can be used with, say, a 12" or even larger picture tube.

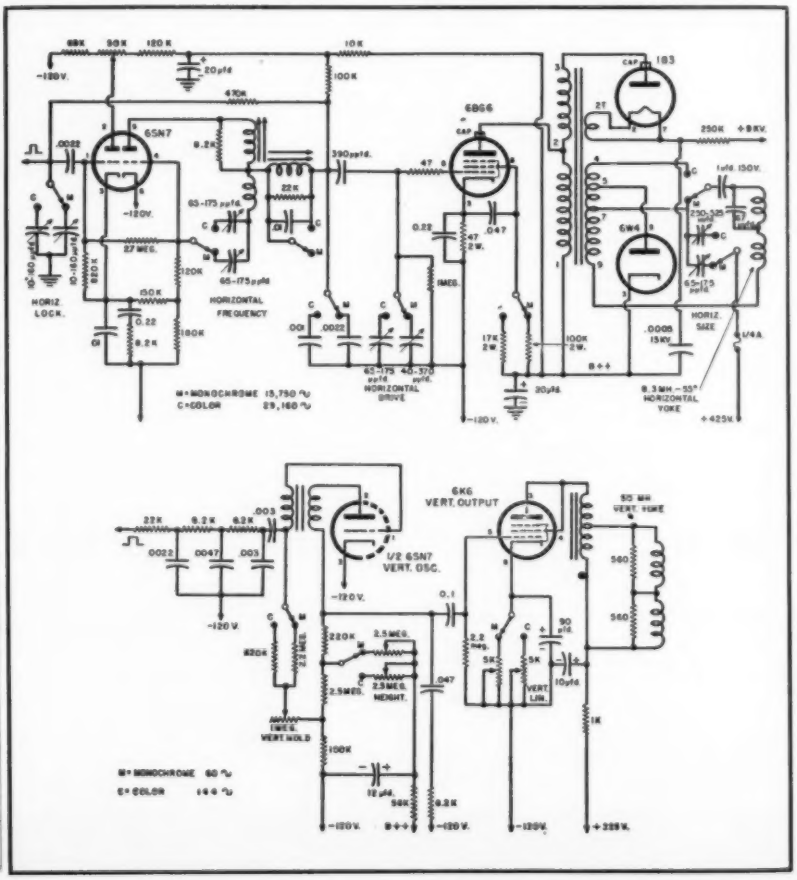
The motor to be used is a split-phase induction type of approximately 1/10 to 1/50 horsepower, depending on the size of the disc to be driven. Many phono motors available today are of this type. They rotate at approximately 1800 rpm. For proper color synchronization the motor must be driven at 1440 rpm. This can be done either by gearing down or using a friction drive. By varying the voltage on the motor or by inserting a rheostat in the line, it is possible to obtain a vernier action. The speed of a motor of this type varies in relation to the applied voltage.

Manually controlled systems of this type will hold synchronization for reasonable periods. They do, however, require frequent readjustment. It does provide an inexpensive method for obtaining color.

There are several commercial methods of electronically synchronizing the color disc with the transmitter. One of these systems operates by comparing the output of the vertical sweep amplifier with the 144 cycle signal coming from the rotating motor. Any difference between these two signals causes a magnetic brake to act and adjust the speed of the motor. More details on systems of this type will be covered in future issues of RADIO & TELEVISION NEWS.

—30—

Fig. 5. An RCA 9T246 television receiver that was converted by Columbia engineers to provide dual-frequency operation. Both conventional black and white and CBS color signals (in monochrome) can be received by simply flipping a panel switch.



To Employers

who need qualified TV technicians

...here's a quick and easy way to train them

Manufacturers... service organizations... dealers... distributors... and other employers of skilled TV technicians who feel the manpower pinch should be interested in this advertisement.

A VALUABLE TRAINING TOOL TO MAKE BEST USE OF MANPOWER RESOURCES

Because of the critical shortage of TRAINED and EXPERIENCED TV SERVICEMEN, RCA Institutes offers a highly specialized and practical Home Study Course in TV Servicing, to the working members of the radio-electronics industry.

The object of the RCA Institutes home study course is to train more *good* servicemen and to help make good servicemen *better*. Also to help expand the supply of qualified TV technicians for industry requirements in face of a manpower shortage. The RCA Institutes Home Study Course in TV Servicing provides an effective way to train men now in your employ to use their latent talents to fill positions that require technical training in television.

STUDENTS KEEP JOBS WHILE TRAINING ...STUDY LESSONS AT HOME

Employed men supplement the practical experience they get while actually working on their regular jobs with pretested technical knowledge learned from a study of the course at home in their spare time. They become more valuable to you as employees with each lesson studied. You quickly train men on the job to utilize their highest skills and capacities. Reduces the need to go outside in the rapidly shrinking manpower market for hard-to-find qualified men. Several thousands of RCA Service Company's own people have taken this course.

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0A3/VR75	$1.69	3C24	$2.25	227A/5C27	$5.95	812H	$6.90	8014	$29.95	0A2	$2.95	5Z4	$1.40	6SN7GT	$1.60	12SL7	$1.10
0B3/VR90	1.29	3C31/CIB	3.49	249C	3.95	813	8.95	8020	1.29	0A4G	1.35	6A3	1.35	6SQ7	1.15	12SN7	1.35
0C3/VR105	1.49	3C45	19.95	250R	12.95	814	3.95	8025	5.95	0B2	2.95	6A4LA	1.45	6SR7GT	1.10	12SQ7	1.25
0D3/VR150	1.29	3CP1	2.25	250TH	22.50	815	2.95	9001	2.25	0Z4	.98	6A6	1.25	6SS7	1.50	12SR7	.98
1B22	3.45	3CP1-S1	2.95	250TL	21.50	816	1.30	9002	2.25	01A	.90	6A7	1.10	6ST7	1.45	12Z3	1.10
1B23	12.50	3DP1	4.95	274A	5.50	826	.98	9003	2.25	1A3	1.32	6A8	1.25	6SU7GTY	2.25	14A4	1.20
1B24	9.95	3DP1A	6.95	274B	2.65	828	12.75	9004	2.25	1A4P	1.49	6AB7	1.49	6SV7	1.45	14A7	1.15
1B26	3.95	3DP1-S2A	8.95	276A	9.95	829	12.95	9005	2.95	1A5GT	1.05	6AC5GT	1.40	6T7G	1.65	14B6	1.15
1B27	24.50	3D21A	1.98	293A	2.98	829B	14.95	9006	.49	1A6	1.10	6AC7	1.65	6T8	1.65	14F7	1.15
1B29	9.95	3E29	14.95	304A	7.75	832	12.95	C1JA	3.95	1A7GT	1.05	6AD7GT	1.65	6U5	1.25	14F8	1.30
1B32	8.95	3FP7	3.95	300B	9.95	832A	12.95	C5B	9.95	1AB5	.98	6AE6G	1.05	6U8GT	1.25	14H7	1.20
1B36	24.96	3GP1	4.75	304TH	27.50	833A	32.95	C6A	7.95	1B3/8016	1.85	6AF6G	1.45	6U7G	1.05	14J7	1.25
1B38	32.50	3HP7	3.95	304TL	23.95	836A	3.95	C6J	8.95	1B4	1.30	6AG5	1.25	6V6	1.00	14N7	1.30
1N21 Xtal	1.25	4-65A	14.21	305A	34.95	837	1.69	C10DD	1.49	1B5/25S	.98	6AG7	1.65	6V6GT	1.50	14Q7	1.15
1N21A ″	2.25	4-125A	26.95	307A/RK75	5.95	838	2.95	CK502AX	2.95	1B7GT	1.75	6AH6	2.10	6W4	1.15	14R7	1.20
1N21B ″	4.25	4-250A	29.95	310A	8.95	841	.45	CK503AX	2.95	1C5GT	.98	6AJ5	2.65	6W7G	1.45	19	1.30
1N23	1.35	4AP10	.65	316A	.65	843	.39	CK505AX	2.25	1C6	1.05	6AK5	2.25	6X4	1.05	24A	1.20
1N23 ″	2.25	4B22/EL5B	9.95	323A/B	24.50	845	4.95	CK506AX	2.25	1C7G	1.05	6AK6	1.85	6X5GT	1.05	2516GT	1.10
1N23A	3.25	4B24/EL3C	7.95	327A/5C37	4.95	849	29.50	CK507AX	2.25	1D5GP	1.15	6AL5	.98	6Y6G	1.25	2525	1.05
1N23B ″	3.95	4B25/6CF	8.95	328A	13.95	851	69.50	CK517AX	8.45	1D8GT	1.15	6AQ5	1.20	6Y7G	1.55	2526GT	1.05
1N27	1.69	4B26/2000	8.95	331A	12.95	852	29.95	CK1005	8.95	1E5GT	1.65	6AR5	1.25	7A4/XNL	1.10	26	.98
1N34	1.40	4B28	4.95	350A	8.95	860	6.95	CK1006	2.25	1E7G	1.55	6AT6	1.05	7A5	1.10	27	.95
1N34A ″	3.95	4B32	9.95	350B	4.95	861	29.50	E1148	.35	1F4	.95	6AU5	2.35	7A6	1.10	28D7	.98
1P23	3.95	4C27/CV92	49.50	368AS	7.95	864	.39	EF50	.69	1F5G	.98	6AU6	1.10	7A7	1.10	30	.89
1P24	1.79	4C35	34.50	371A	1.49	865	1.49	F123A	8.75	1G4	1.10	6AV6	1.05	7A8	1.10	31	.89
1P36	4.95	4E27/257B	17.50	371B	.98	866A	1.39	F127A	22.50	1G6GT	.95	6B6G	1.25	7AG7	1.65	32	1.05
1R21	6.95	5AP1	3.69	388A	2.75	866JR	1.29	F128A	89.50	1H4G	.95	6B7	1.25	7B4	1.10	321.7GT	1.15
2AP1	11.95	5AP4	3.69	393A	6.95	869B	49.50	F160	27.50	1H5GT	1.05	6B8G	1.25	7B5	1.10	33	1.05
2AP5	6.95	5BP1	5.95	394A	4.95	872A	2.95	F660	79.50	1H6GT	1.48	6BA6	1.05	7B6	1.10	34	.98
2C21/RK33	.69	5BP4	5.95	417A	12.95	874	1.49	FG17	3.95	1J6	1.35	6BC5	1.25	7B7	1.10	35/51	.98
2C22/7193	.49	5CP1	4.95	434A	4.95	876	1.89	FG27A	8.75	1L4	.98	6BE6	1.15	7C4	1.79	35A5	1.10
2C26A	.49	5CP7	4.95	446A	9.95	878	2.25	FG32	7.95	1LA4	1.15	6BF6	1.05	7C5	1.10	35B5	1.10
2C34/RK34	4.95	5C22	55.00	446B	4.95	884	1.85	FG57	14.95	1LA6	1.35	6BG6G	2.45	7C6	1.25	35L6	1.25
2C39	24.50	5D21	24.50	450TH	47.50	885	1.49	FG81A	3.95	1LB4	1.35	6BH6	1.25	7C7	1.20	35L6GT	1.30
2C40	8.95	5FP7	1.95	450TL	47.50	902	11.95	FG105	22.95	1LC5	1.20	6BJ6	1.25	7E5	.89	35W4	1.25
2C43	9.95	5GP1	4.95	527	12.75	905	3.89	FG172	34.50	1LC6	1.18	6BQ6	2.50	7E6	.89	35Y4	1.05
2C44	1.49	5JP1	24.45	559	1.39	908	12.95	FG146	8.95	1LD5	1.30	6C4	1.49	7E7	1.05	3523	1.05
2C46	7.50	5JP2	24.45	562	97.50	918	1.89	FG434A	4.95	1LE3	1.30	6C5	.98	7F7	1.10	3524	1.05
2C51	9.95	5JP4	24.45	575A	39.95	919	2.79	FG451	.89	1LG5	1.15	6C6	1.10	7H7	1.10	3525	1.05
2D21	1.79	5J23	12.95	701A	5.95	922	.98	FG502A	1.85	1LH4	1.75	6C8G	1.10	7K7	1.49	36	1.05
2E22	1.95	5J29	12.95	702A	3.95	923	1.05	FG502	97.50	1LN5	1.30	6CB6	1.10	7L7	1.10	37	.89
2E24	3.95	5J30	49.50	703A	7.95	927	1.59	FG592	14.95	1N5GT	1.05	6D6	1.10	7N7	1.65	38	.98
2E26	3.69	5J32	99.50	704A	1.05	930	1.20	HF125	14.95	1P5GT	1.05	6D8	1.15	7Q7	1.10	39/44	.68
2E30	2.29	5LP1	15.95	705A	2.95	931A	4.95	HF300	19.95	1Q5GT	1.18	6F5	1.05	7S7	1.10	41	.98
2J21A	9.95	5NP1	5.95	706BH	39.50	954	.39	HY114B	.79	1R4	1.05	6F6	1.25	7S7	1.35	42	.98
2J22	8.45	6AS6	3.69	706CY	39.50	955	.45	HY115	.79	1R5	1.39	6F7	1.05	7V7	1.35	43	.98
2J26	29.50	6C21	24.50	706FY	42.50	956	.45	HY615	.79	1S4	1.50	6F8G	1.35	7W7	1.45	45	1.10
2J27	29.50	6F4	5.95	706HY	42.50	957	.45	KC4	37.50	1S5	1.50	6G6G	1.35	7X7	1.69	4523	1.05
2J30	99.50	6J4	6.95	707B	17.95	958	.45	KU610	6.95	1T4	1.50	6H6	1.25	7Y4	.98	4525	1.05
2J31	39.50	7BP7	8.95	708A	4.95	959	.45	ML101	69.50	1U4	1.30	6H6GT	.98	7Z4	.98	46	1.10
2J32	39.50	9GP7	14.95	709A	3.95	991/NE16	.39	RELZ1	3.95	1U5	1.30	6J5	.89	12A	.79	47	1.10
2J33	39.50	9JP1	14.95	710A/8011	1.95	1603	9.23	RK20	9.95	1V	.89	6J5GT	.79	12A6	.75	48	2.15
2J34	39.80	9LP1	19.95	713	1.45	1613	2.25	RK25	4.49	1X2	1.95	6J6	1.75	12AT	1.25	49	1.10
2J36	97.50	10BP4	22.50	714AY	6.95	1614	2.25	RK30	.89	2A3	1.65	6J7	1.40	12AU6	1.39	50A5	1.10
2J37	12.75	7DP4	17.95	715B	9.75	1616	.98	RK33	.89	2A4G	1.40	6K5GT	1.35	12AU7	1.05	50B5	1.25
2J38	12.75	7DP4	17.95	715C	29.95	1619	.39	RK34	.89	2A5	1.05	6K6GT	1.30	12AV6	1.10	50C5	1.25
2J39	39.80	10	.49	717A	1.45	1622	3.25	RK48A	4.49	2A6	.98	6K7	1.05	12AT6	1.05	50L6GT	1.15
2J40	39.50	12DP7	16.95	721A	2.59	1624	1.98	RK59	1.49	2A7	.98	6K8	1.35	12AT7	2.25	50Y6	.89
2J46	39.50	12GP7	16.95	722A	2.95	1625	.45	RK60/1641	1.69	2B7	1.20	6L5G	1.25	12AU6	1.39	53	1.35
2J48	29.50	12HP7	16.95	723A/B	9.95	1626	.45	RK65	24.50	2D21	.98	6L6	3.05	12AV6	1.10	56	.98
2J49	39.50	12LP4	22.50	723A	9.95	1629	.35	RK72	.59	2V3G	.98	6L6G	2.65	12AV7	1.15	57	1.05
2J50	22.50	15E	1.19	723A/B	14.95	1630	.98	RK73	.59	2X2	.65	6L6GA	2.65	12AV6	1.10	58	1.05
2J54B	39.50	15B	.89	724B	3.89	1631	1.29	RX21A	2.95	2X2A	1.95	6L7	1.69	12BA6	1.25	59	1.25
2J55	97.50	16AP4	42.50	725A	7.50	1632	.79	RX120	8.95	3A4	1.25	6L7G	1.25	12BE6	1.25	7Q7	1.25
2J61	49.50	16CP4	42.50	726A	6.95	1633	.75	V70D	6.95	3A5	1.95	6L7GT	1.40	12C8	1.05	71A	1.25
2J62	49.50	19T8	2.90	726B	29.50	1634	.75	VR78	.69	3B7/1291	.89	6N7	1.40	12CR6	.98	75	1.25
2K25/		23DA	.45	726C	49.50	1636	.98	VR91	1.49	3D6/1299	.89	6Q7	1.45	12FS6GT	.98	76	.89
723AB	29.50	28D7	.98	730A	12.95	1638	3.25	VR92	1.49	3LF4	1.10	6R7	1.20	12H6	.98	77	.89
2K28	36.25	30 Special	.59	750TL	79.50	1638	.65	VT127A	3.95	3Q4	.95	6S7G	1.59	12J5GT	.79	78	1.10
2K29	24.50	35TG	4.95	800	1.95	1640	.98	VT158	14.95	3Q5GT	1.25	6S8GT	1.35	12J7GT	1.05	80	1.20
2AP1	12.95	45 Special	.39	801A	.49	1644	.98	VU29	1.49	3S4	1.25	6SA7	1.45	12K7GT	1.05	82	1.20
3B22/Elic.	2.95	53A	5.95	802	4.49	1654	2.39	VU111	1.49	3V4	1.25	6SC7	1.75	12K8	1.05	83	1.35
3B23/RK22	4.85	73TL	6.95	803	4.49	1665	4.49	WL468	12.95	5R4GY	3.75	6SD7GT	1.50	12Q7	.98	83V	1.35
3B24	6.95	100R	.89	804	9.95	1851	1.89	WL530	12.75	5T4	1.95	6SF5	1.10	12SA7GT	1.15	84/6Z4	1.10
3B24W	7.98	100TH	9.95	805	4.49	1960	.79	WL531	12.75	5U4G	.98	6SF55GT	1.20	12SC7	1.45	85	1.10
3B25	4.65	121A	2.98	806	29.95	1961	4.59	WL532	2.95	5V4G	2.40	6SF7	1.25	12SF5	1.05	90V	.89
3B26	3.95	203A	8.95	807	1.95	2050	1.29	WL578	1.29	5W4	1.10	6SG7	1.50	12SF7	1.05	117L7/M7	1.75
3B27	3.95	204A	69.50	808	7.25	2051	1.45	WL616	37.50	5X4G	1.28	6SH7	1.10	12SG7	1.05	117N7	1.75
3B28	8.95	211	.69	809	2.45	8005	5.95	WL619	10.95	5Y3GT	.89	6SJ7	1.30	12SH7	1.05	117P7	1.75
3BP1	8.95	212E	49.50	810	9.95	8011	1.75	WL677	34.50	5Y4G	1.15	6SK7	1.50	12SJ7	1.15	117Z3	1.05
3C22	64.50	215A	.19	811	3.25	8012	2.95	WL681	22.50	523	1.05	6SL7GT	1.50	12SK7	1.50	117Z6	1.25
3C23	9.95	217C	8.95	812	2.95	8013	2.95										

FULL-WAVE SELENIUM RECTIFIER STACKS

Max. A.C. Input Volts RMS	Max. D.C. Volts Output	Cell Size in Inches	Max. D.C. Amps. Output Continuous	Order by This Number	Price
SINGLE PHASE BRIDGE					
0-18 0-14.5	13/4″	x1¾″	1.3	18B4D1S1	$ 3.95
″ ″	2-3/16″	x2-3/16″	2.4	18B4E1S1	4.95
″ ″	3⅛″	x3⅛″	0.6	18B4F1S1	7.95
″ ″	4½″	x5″	13.0	18B4K1S1	12.95
″ ″	5″	x6″	17.5	18B4J1S1	15.45
″ ″	4½″	x5″	26.0	18B4K1S2	22.50
″ ″	4½″	x5″	39.0	18B4K1S3	37.50
″ ″	4½″	x5″	52.0	18B4J1S3	47.50
″ ″	4½″	x5″	70.0	18B4J1S4	54.50
0-40 0-34	13/4″	x1¾″	0.60	40B4D1S1	4.95
″ ″	2-3/16″	x2-3/16″	1.2	40B4EW1S1	6.95
″ ″	3⅛″	x3⅛″	3.2	40B4FW1S1	9.75
″ ″	4½″	x5″	6.0	40B4K1S1	14.95
″ ″	5″	x6″	9.0	40B4JW1S1	17.50
″ ″	4½″	x5″	12.0	40B4K1S2	28.75
″ ″	5″	x6″	18.0	40B4JW1S2	34.50
″ ″	4½″	x5″	25.0	40B4J1S3	42.50
″ ″	4½″	x5″	34.0	40B4J1S4	54.25
″ ″	5″	x6″	36.0	40B4JW1S4	63.25
0-120 0-100	13/4″	x1¾″	0.60	40B4D3S1	12.45
″ ″	2-3/16″	x2-3/16″	1.2	40B4EW3S1	14.95
″ ″	3⅛″	x3⅛″	3.2	40B4FW3S1	24.50
″ ″	4½″	x5″	6.0	40B4K3S1	32.50
″ ″	5″	x6″	9.0	40B4JW3S1	43.50
CENTER-TAP					
10-0-10 0-8	13/4″	x1¾″	1.2	20C2D1S1	2.35
″ ″	2-3/16″	x2-3/16″	2.4	20C2EW1S1	3.10
″ ″	3⅛″	x3⅛″	6.4	20C2FW1S1	6.95
″ ″	4½″	x5″	12.0	20C2K1S1	8.95
″ ″	5″	x6″	16.0	20C2J1S1	8.95
″ ″	4½″	x5″	24.0	20C2K1S2	14.75
″ ″	4½″	x5″	36.0	20C2K1S3	19.85
″ ″	4½″	x5″	48.0	20C2J1S3	27.50
″ ″	4½″	x5″	64.0	20C2J1S4	34.50
″ ″	4½″	x5″	80.0	20C2J1S5	42.50
″ ″	4½″	x5″	84.0	20C2KW1S7	49.50
″ ″	5″	x6″	96.0	20C2J1S6	58.50
″ ″	4½″	x5″	128.0	20C2J1S8	67.50
3 PHASE BRIDGE					
0-120 0-150	13/4″	x1¾″	0.90	40B6D3S1	24.50
″ ″	2-3/16″	x2-3/16″	1.8	40B6FW3S1	29.50
″ ″	3⅛″	x3⅛″	4.75	40B6FW3S1	42.50
″ ″	4½″	x5″	9.0	40B6K3S1	79.50
″ ″	5″	x6″	12.5	40B6J3S1	86.75

SPECIAL RECTIFIERS ON REQUEST

TRANSFORMERS—115V 60 CY HI-VOLTAGE INSULATION

2700v @ 2 MA; 6.3v @ .6A; 2.5v @ 1.73A	$ 4.45
2500v @ 15 MA	3.49
1540v @ 5 MA; 340-0-340 @ 300 MA	4.35
925v @ 10 MA; 525-0-525v @ 60 MA; 2X5v @ 2A; 6.3v @ 3.6A; 6.3v @ 2A; 6.3v @ 1A	4.85
415-0-415v @ 60 MA; 5v CT @ 2A; 115/230 Dual Pri	4.25
400-315-0-100-315v @ 200 MA; 2x6.3v @ 6A; 5v @ 3A; 2.5v @ 2A	5.35
500-385-0-385v @ 200 MA; 3x6.3v @ 6A; 5v @ 3A; 2.5v @ 2A	4.75
325-0-325v @ 12 MA; 235-0-235v @ 240 MA; 300-0-300v @ 65 MA; 6.3v @ 2.5A; 6.3v @ 1A; 2x5v @ 2A	4.25
0-17.4/21.6/25.8v @ 400 MA; 6.4v @ 5A; 2.6v CT @ 2.5A Pri 115/230	3.25
12.6v CT @ 10A; 11v CT @ 6.5A	3.85
3x10v @ 7A	6.35
6.3v @ 12A; 6.3v @ 2A; 115v @ 1A	6.95
6.3v @ 8A; 6.3v @ 6A; 2.5v @ 1.75A	3.50
6.3v @ 1A; 2.5v @ 2A; $2.29 4-0-4v @ 1A	4.17
6.3v CT @ 1A	.87
5v CT @ 20A; 10 KV INS	1.29
.6v @ 15A RMS	5.95
	1.47

TRANSFORMERS—220v 60 Cyc

512.5-0-512.5 @ 427 MA	$ 5.35
3x5v @ 6A; 4v @ .25A	2.95
3x6.3v CT @ 3A; 6.3v CT @ 1.6A	2.95
10v CT @ 6.5A; 6.3v CT @ 2.5A; 6.3v CT Step Up/Down 110/220, 500 watt	3.95 10.95

FILTER CHOKES HI V INS

.025 HY @ 1.36A.	$1.98	10/20 HY @ 85 MA.	$1.49
3 HY @ 50 MA.	.39	15 HY @ 100 MA.	1.69
5 HY @ 70 MA/.2 HY @ 350 MA Dual	2.39	5.3 HY @ 225 MA.	2.79
10 HY @ 55 MA.	.89	6.6 HY @ 175 MA.	2.10
10 HY @ 250 MA.	3.95	8 HY @ 150 MA.	1.79
10 HY @ 100 MA.	1.29	200 HY @ 10 MA.	2.95
13 HY @ 130 MA.	1.99	325 HY @ 2 MA.	2.95
15 HY @ 70 MA.	1.39	600 HY @ 1 MA.	2.95
		9/60 HY @ 50/400 MA	9.95

OIL CONDENSERS—DC RATINGS

3X.1	MFD	600v	$ .59	.1	MFD	2500v	$1.15
.25	″	″	.35	.25	″	″	1.25
.5	″	″	.45	.5	″	″	1.35
1	″	″	.69	2	″	″	3.45
2	″	″	.85	.01	″	3000v	1.25
2X2	″	″	1.15	.05	″	″	1.30
4	″	″	1.29	.1	″	″	1.35
6	″	″	.98	.25	″	″	2.75
8	″	″	2.49	.5	″	″	2.85
10	″	″	2.79	1	″	″	2.95
3X.1	″	1000v	.85	2	″	″	4.25
.5	″	″	.89	4	″	″	6.95
1	″	″	.67	12	″	″	9.95
2	″	″	1.75	1	″	3600v	3.98
4	″	″	1.85	.25	″	4000v	3.49
8	″	″	3.55	.5	″	″	3.75
10	″	″	3.19	1	″	″	3.95
20	″	″	4.25	2	″	″	5.75
.5	″	1500v	1.02	3	″	″	5.89
1	″	″	1.19	.1	″	5000v	2.75
2	″	″	1.69	.25	″	″	2.95
4	″	″	2.69	1	″	″	3.10
.1	″	2000v	1.75	.1	″	7000v	3.75
.25	″	″	1.92	.01	″	7500v	2.25
.5	″	″	1.95	.02	″	″	2.25
1	″	″	2.09	.03	″	″	2.35
2	″	″	2.85	.05	″	″	2.35
4	″	″	4.45	.1	″	″	4.95
8	″	″	4.95	2X.1	″	″	7.95
15	″	″	6.95	.02	″	12000v	12.95

HIGH CAPACITY CONDENSERS

2X3500	MFD	25v	$3.47	200	MFD	35v	$ .57
2500	″	3v	.35	100	″	50v	.45
3000	″	25v	2.45	4000	″	30v	3.25
650	″	80v	1.29	2350	″	24v	2.25
2000	″	15v	1.69	10000	″	25v	4.57

WANTED! WANTED!

ATTENTION colleges, schools, hams, industrials!! Highest prices paid for surplus equipment, parts, and tubes. We are especially looking for test equipment TS-12, 13, 35, 14/AP, 15/AP, 146/UP, 173, 174, 175, 239, 259, 263. Any types with TS prefix. Write, wire or call.

R·H·S

SPECIALS OF THE MONTH

WANTED! WANTED!

APR-4, 5, 7 and tuning units. ARC-1, 3. ART-13, ATC, APS-10, microwave equipment in S, K, X-band. APS-15, APQ-13, APS-13, SCR-300, 284, 694, etc. BC-221, 342, 348. BC-1016 tape recorders. Write, wire or call.

RADAR—COMMUNICATIONS AND TEST EQUIPMENT

TS-35/AP X-band Signal Generator. Pulsed and C.W. freq. range. 8400-9600 mcs. This unit will measure power and frequency. 115v 60-2600 cyc.

TS-3/AP S-band Frequency and Power Meter. Portable. Battery operated. Complete with all cables.

TS-33/AP X-band Frequency Meter. 8500-9600 mcs. Contains crystal detector and indicating meter. Output to scope will indicate pulse wave shape.

TS-62/AP X-band Echo Box. 8400-9600 mcs. tuned and untuned input. Will indicate resonance on meter. Complete with pick up antenna and cable.

TS-268/UP Crystal Diode Test Set. Used to check 1N21, 1N22, 1N23, etc. Battery operated. Portable. Complete with spares.

TS-89/AP Voltage Divider. 1:10 and 1:100 ratios. Wide band for true pulse shape. Output to scope.

TS-10/APN Altimeter Test Set. Good condition. Complete with cables and dummy antenna **$35.00**

TS-12/AP V.S.W.R. Test Set for X-band. Complete with amplifier, slotted line, termination, adaptors, etc. In 2 carrying cases. Excellent.

TS-45/APM-3 X band signal generator. 8400-9600 mcs pulsed & CW output. Used to check APS4 and similar sets.

TS-36/AP X-band Power Meter. Consists of power measuring circuit. Horn antenna, co-ax to wave guide adaptor, connecting cable and probe. Will measure either absolute or relative power. Nominal band of usefulness is approx. 8.5-9.7 KMC. Excellent condition.

TS-118/AP R.F. Wattmeter for the range of 20-750 mcs. Will measure power up to 500 watts. Complete.

TS-174/U Freq. Meter. Freq. range is 50-250 mcs. High freq. version of BC-221. Excellent Condition **$385.00**

1-185 Signal Generator. L-band search. S-band track. Used with SCR-545 and similar sets. Complete with cables. Good condition.

TS-61/AP S-band Echo Box. Using meter provided it is possible to maximize the XMTR adjustment and determine relative power output. Complete with probe and cable. Very good condition.

TS-13/AP Xa band signal generator, wave meter, wattmeter. Precision lab microwave. Test set. Will provide either pulsed or CW output in Xa band. Input 115v 60-800 cyc.

TS-226/AP used to measure peak power output of any xmitter in the range of 200-1000 mcs. Has provision for oscilloscopic signal observation and built in calibration. Part of AN/APM-29. Excellent.

TSX-4SE X-band spectrum analyzer. Unit will analyze magnetron & klystron output from 8400-9600 mcs. Double moding, pulling, sparking, etc., can be observed. 115v 60 cyc input.

TS-14/AP consists of S-band signal generator, freq. meter, wattmeter and cables. Power input is 115v 50-2600 cyc. Used to check various S-band radars and beacons.

TS-170/ARN-5 XTAL controlled test osc. with the following freq. ranges: 332.6, 333.8, 335.0 depending set on XTAL in use. This set is used to align glide path receivers. Batteries and antenna are self contained. Excellent condition.

AN/APS-3 Airbourne X-band Search and Homing radar. Complete. Contains RF head, modulator, synchronizer, control boxes, plugs, antenna, etc. 115v 400 cyc. Excellent condition. . . . **$875.00**

ASB-5 L-band Search and Homing radar. Complete. Contains xmitter, receiver, power unit, control box, plugs, etc. 115v 400 cyc. Excellent condition **$125.00**

SCR-518 Radar Altimeter. 500 mcs. equipment. Complete with xmitter, receiver, control box, power unit, junction box with all cables, racks, etc. Unit will indicate altitude up to 50,000 ft. Power input is 28v. New condition **$99.50**

AN/APS-15 R.F. Head and Modulator. X-band. Complete with all tubes. Good condition . . **$99.50**

AN/APA-23 Automatic Signal Strength and Time Recorder. Unit will scan a receiver thru its range and record all signals on electrosensitive paper. Input is 115v 60-2600 cyc. and 28v DC. Excellent condition **$175.00**

DYNAMOTORS AND POWER UNITS

Type	Input Volts	Output Volts	Amps	Price
DM-19	12	500	.200	$ 6.95
PE-125	12v/24v	475	.200	14.50
DM-32	28	250	.060	1.75
DM-33	28	570	.160	2.95
DM-34	12	220	.080	8.95
DY-12	12	275	.110	
		500	.50	
PE-73	28	1000	.350	10.00
PE-94	28	300	.260	
		150	.010	
		14.5	.5	2.25
PE-97	Vibrator Power Supply			8.95
PE-98	12v	300v		35.00
PE-101	28	400		
		800		5.75
PE-103	6 & 12	500	.160	35.00
PP-18-AR	Vibrapack			15.95
RA-42	(for BC-639 Receiver)			29.95
ATR	Inverter 12v	110v AC 125 watts		14.95

PHONE DIGBY 9-0347

WRITE FOR QUANTITY PRICES

Prices subject to change without notice. F.O.B., NYC minimum order $10.00. 20% deposit required. All merchandise guaranteed.

AN/CRT-3 Victory Girl. Dual frequency emergency lifeboat xmitter. Complete with xmitter, kite hydrogen generator, etc. New in knapsack. C.A.A. approved **$69.50**

AN/APR-5 Radar Search Receiver. Freq. range 1000-3100 mcs. Will detect signals up to 10,000 mcs. with reduced sensitivity. Contains oscillator and mixer cavity, IF strip, power supply. Input 60-2600 cyc. 115v. Excellent condition . . **$375.00**

T-50 Radiotelegraph Transmitter complete with power supply and all accessories with spares. Portable. New in cases **$275.00**

AN/APT-5 300-1500 mcs. xmitter cavity oscillator using 3C22 lighthouse tube. Power output 30 watts. Noise modulated. Excellent condition. Complete with all tubes **$149.50**

SK-1M Radar Receiver Indicators. Freq. 195 mcs. 2 R.F. stages, 3 IF stages. 1 video, etc. New condition **$125.00**

SCR-183 Airbourne Command Equipment. Freq. range 201-398KC and 2500-7700KCS. Complete. Contains receiver, xmitter, dynamotor, antenna switch, control box, coils, etc. Power input 24-28v. Brand new in original cases. Manufactured by Western Electric **$125.00**

NAVY RU Command Equipment. Similar to SCR-183 ..... **$125.00**

DU-1 Direction Finding Equipment for SCR-183 and RU Series Equipment. Can be used with any receiver for direction finding in freq. range 200-1600KC. New. Complete **$45.00**

SCR-515 (BC-645) contains xmitter, receiver, dynamotor PE-101, control box, manual, etc. New **$18.95**

AN/PPN-1 EUREKA! Ground portable, beacon responder. Unit will work into the AN/APN-2 transponder for purposes of homing. C.W. communication can also be carried on between plane and ground. Unit comes complete with xmitter, receiver, power pack, phones, etc. Brand new in knapsack, AN/APN-2 EQUIPMENT CAN BE SUPPLIED ON ORDER.

SCR-269/G Automatic Radio Compass. Freq. range 200-1750KC. Complete with BC-433-G receiver, BC-434, LP-21, 1-81, 1-82, BK22, etc. Very good condition **$129.95**

SCR-300 Frequency Modulated Transceiver. Freq. range 40-48 mcs. complete with 18 tubes, handset and antenna. Powered from self contained battery pack. Excellent condition. Weight approx. 35 lbs. with battery, each . . . **$275.00**

TCS Marine Radio Telephone and Telegraph Xmitting and Receiving Equipment. Freq. range 1500-12000KC. Consists of xmitter, receiver, antenna loading coil, remote control box, power unit, cables, etc. Power input is 12 or 32v DC. We can supply an 110v AC power supply for stationary use at additional cost. Excellent condition.

SCR-536 Xmitter-Receiver (handy talkie). Freq. range 38-50 mcs. Complete with coils, tubes, crystals. Very good condition **$89.95**

AN/APA-10 Panoramic Adaptor for use with any receiver with following IF's: 455KC, 5 mcs, 30 mcs. Unit will give panoramic presentation (1 mc wide for 455KC input) (100KC for 5MC input) (2MC for 30 mcs input). Power input 115v 400 cyc. but can be changed with the addition of a proper power transformer. Excellent condition **$175.00**

10 CM R.F. package. 2700 mcs. Consists of BC-1007 modulator & BC-1091 RF head. Power output approx. 40 KW. Complete with tubes **$195.00**

RT-39/APG-5 10 CM LHTR R.F. head & modulator. Low power approx. 2 KW. Lighthouse tube rec & trans w/T.R. tunable. New **$135.00**

SCR-510 Freq. Modulated Portable Transceiver. Covering range of 20.0-27.9 mcs in 80 channels 100KC apart. Complete equipping consisting of BC-620 transceiver, power supply PE-97A, T-17 mike, handset, AN-45 antenna, battery operated or 6 or 12v input. Excellent condition . . **$69.95**

SCR-610 similar to SCR-510 except for freq. range which is 27.0-38.9 mcs. Excellent condition **$79.95**

AN/APA-11 Pulse Analyzer to work with Search Receiver for analysis of received pulsed signals. PPS, pulse width, wave shape, can be displayed on an CR tube. Unit can also be used as a standard oscilloscope for general servicing work. Input is 115v-400-2600 cyc. but can be changed with the addition of a 60 cyc. transformer. Very good condition.

SCR-694 Field Radio. Light weight version of SCR-284. Freq. range is 3.8-6.5 mcs. Power output is A1-20, A3-5; comes with transceiver BC-1306, GN-45 or 58 hand generator, antenna system, microphone, headset, etc. In excellent condition.
PE-237 AC Power Supply for stationary use can be supplied at additional cost.

SCR-522 VHF Airbourne Command Equipment. Freq. range 100-156 mcs. in 4 channels receiver and transmitter. Crystal controlled. Complete equipment. Consists of trans/rec, control box BC-602, dynamotor PE-94, AN104A antenna, plugs, etc. Power input with PE-94 is 28v. Excellent condition. We can supply PE-98 dynamotor for 12v input at additional cost.

COMMAND EQUIPMENT

ARC-5 274N OTHERS

RECEIVERS

ARA 500-1500KC. New **$24.95**
453B 200-550KC. Good **19.95**
455B 6-9 mcs. Good **19.95**
433 200-1750KC. Good **29.95**
ARR-2 234-258 mcs. New **19.95**

TRANSMITTERS

459-A 7-9.1 mcs. Good **$19.95**
696-A 3-4 mcs. New **29.95**
TYPE O 5.3-7 mcs. New **9.95**
AVT-23 3000-13,000KC complete w/control box, manual, etc. C.W. or phone. 14 or 28v input. Brand new. Original cases. . . **79.50**
BC-950A 100-156 mcs. New **89.95**

ACCESSORIES

BC-456 Modulator. Good **$2.25**
BC-450 Control Box (3 rec). Used **1.25**
BC-451 Control Box (xmitter). Used ..... **.98**
BC-442 Relay Unit (ANT). Used **1.95**
Flexible Shafting Available

MISCELLANEOUS SPECIALS!

Sound Powered Chest and Headsets MI-2454-B type O, mfg. RCA. Brand new in original boxes. Pair ..... **$ 29.95**
Trailing Wire Antenna Feed Tube. New . . . **5.95**
Goniometer for SCR-277 Direction Finder. Excellent **39.95**
RL-7 Interphone Control Box. New **1.95**
FT-134 BC-348 Shock Mounts **2.98**
AN/CRW Receiver for Remote Control . . . **5.95**
BC-1206 Beacon Receiver 200-400KC, 28v in. Excellent **4.95**
MN/26-Y Compass Receiver. Very good . . . **24.95**
BC-433G Compass Receiver, 200-1750KC in 3 bands. Excellent **39.95**
BC-778 Gibson Girl 500KC. Good condition **3.95**
BC-1016 Tape Recorder. Complete. New . . **459.50**
CFI Unit with 200KC Xtal. New **14.95**
BC-733D receiver with tubes **29.95**
BC-329 Transmitter. Excellent **89.95**
QBG-1 Sonar complete with Hydrophone. Excellent **125.00**
BC-608 automatic keyer for SCR522 . . . . **5.95**
AN/104A Antenna for SCR-522, ax handle. New **3.95**
BC-1284 Lighthouse Tube Preamplifier. Excel. **69.95**
ASB 500 mcs YAGI Antenna Dual 6 Element **14.95**
Single 5 Element **8.95**
AN/APA-17 Radar Direction Finding Antenna, back to back parabola, freq. range 300-1000 mcs. Horizontally and vertically polarized. Excellent **59.00**
BC-996 Interphone Amplifier. Good **9.95**
ART-13 Loading Condenser. Excel **4.95**
CW-3 less coil & crystals. New **29.50**
CU-25 Loading Box for ART-13 ..... **49.95**
AS-27/ARN5 Antennas. Very good **4.95**
SA-1/ARN-1 Lart of ARN-1. Very good . . **2.95**
1D-80/APA-17 Indicator. Excel **129.95**
RBM-4 Receiving Central. Complete with all power supplies, carrying case and cables. New **325.00**
AVR-15 Aircraft Receiver. Very good **19.95**
BC-923 Receiver. Very good **39.95**
BC-800 Xmitter/Receiver. Very good . . **39.95**
RA-300 FM Exciter (Mfg. Tempco). New **32.50**
A-55 Dummy Antennas. Very good **2.25**
BC-1365 Control Box. Good **3.95**
FL-8 Filter **3.95**
FL-5 Filter. Less cables. Fair **2.65**
3C-16-D GSAB Gun Camera Computers with all access. In carrying case. Excel. **19.95**
AT-2A/APN-2 Antenna. Fair cond **4.95**
Spares for ARC-5 and 274/N, APX-1, ASG-1G. We have a large stock of TS-34A/AP Spares.

CORDS AND PLUGS

CG-(172/173) CPN-8 CM Coax Patch Cable. New **$4.95**
CX-548/CRD-3 Cable. New **1.25**
CX-546/CRD-3 Cable. New **1.25**
CD-508A w/SW 14-U & 2 Cord Attachments with JK-48 Jack & PL-68 Plug. New . . **.75**
CD-307A with PL-55 and JK. New **1.29**
PL-55 Plug. New ..... **.49**
83-168 Adapter. New ..... **.17**
83-1SP Connector. New ..... **.69**
83-1R Coax Connector. New ..... **.69**
83-1AP Angle Coax Connector. New ..... **.22**
83-1J Feed Thru. New ..... **.90**
83-1F Feed Thru. New **1.30**

BC-221 FREQUENCY METER

This is a Terrific Value! QUANTITY IS LIMITED—so first come, first served. They are just like new, with original calibration charts. Range 125-20,000 KC with crystal check points in all ranges. Complete with crystal and tubes. **ONLY $72.50**

RADIO HAM SHACK Inc.

189 GREENWICH STREET . NEW YORK, N. Y.

of the acoustics of hundreds of theaters throughout the United States, and then setting a recording characteristic that could be reproduced with good results in the average theater. Also, theater projection equipment is maintained at a certain characteristic so that the best results will always be obtained.

It is the policy of the major motion picture studios to completely re-record the sound before releasing, at which time frequency corrections and levels are ironed out for a uniform product. During this process a low-pass filter having the characteristics of the *average* theater is used in the monitor system so that the final product, from a listening standpoint, will be similar to that heard in the average theater.

This brings us up to a point that the television industry might well consider: Kinescope and produce motion pictures for television with a frequency characteristic that is the most suitable for television listening, based on the average acoustic response of the listening home. Also provide the manufacturers of television receiving equipment with specifications on a two or three position equalizer with a cut-off frequency characteristic suitable for both 16 mm and 35 mm film reception and straight FM sound.

To carry this a step further, television stations should attempt to transmit the sound track with a standard frequency response so that the listener with a receiver so equipped would obtain the best results.

The control in the television receiver should be so designed that both the low and high frequencies are properly compensated to maintain the proper aural balance. The control would be labeled, "FM, Film: 1,2,3."

As the listener would have no way of knowing what type of film was being transmitted, he would select the position that gave the best reproduction. Of course this would not fit all situations, but would be an improvement over the condition as it now exists.

At present the situation may be likened to that encountered in disc recording, a situation which is being cleared up rapidly with the cooperation of the recording activities and the manufacturers of record reproducing equipment.

Next we have the studio microphones which may be used for announcing, sound effects, or music pick-up. If the studio pickup involves music, vocal, and dialogue, separate microphones may be required. The dialogue microphone should have the low frequency end reduced approximately 3 to 6 db at 100 cycles to remove any "tubbiness" in the voice. If the microphone is a ribbon velocity, this may be done by connecting the "voice filter" in the microphone, or attenuating the low frequencies at the mixer console. (High and low frequency attenuation will be discussed later with the mixer.)

RELAYS FOR EVERY PURPOSE




RECENT ADDITIONS TO OUR STOCK OF OVER A MILLION RELAYS . . .

Each relay is brand new, standard make, inspected, individually boxed and fully guaranteed.
This is only a partial list. Write or wire us for information on types not shown.

STANDARD DC TELEPHONE RELAYS

Stock No.	Voltage	Ohmage	Contacts	Unit Price
R-868	30/162 VDC	3300	1C	$1.90
R-873	6	12	3C, 3A Micalex	3.00
R-918	52/228 VDC	6500	1C	1.60
R-852	52/228 VDC	6500	1C, 1A	1.55

SHORT TELEPHONE RELAYS

R-907	24/32 VDC	3500	1C	2.00
R-914	110 VAC	200	3B	2.50
R-908	6 VDC	15	4A @ 4 amps.	1.50

KEYING RELAYS

R-850	12 VDC	450	1A @ 1.5 amps.	1.50
R-935	28 VDC	1000	1C @ 1.5 amps.	1.65
R-949	2.4 VAC	...	1A @ 5 amps.	1.95
R-891	24 VDC	475	1C @ 5 amps.	1.45
R-858	27.5 VDC	250	1A Dbl. Brk.	1.45
R-833	6.5 VDC	1300	2C	3.05
R-960	24 VDC	230	3C @ 15 amps.	2.95
R-828	6/8 VDC	42	1A	1.50
R-855	110 VAC	160	1A Dbl. Brk. @ 15 amps.	3.25
R-948	110 VAC	330	3A @ 15 amps.	3.00
R-924	12 VDC	72	1C Dbl. Brk.	1.65
R-950	2.4 VAC	...	1A @ 8 amps.	2.25
R-978	6 VAC	1.7	1A 1B @ 1.5 amps.	1.95
R-979	6 VAC	1.7	2A @ 1.5 amps.	1.95
R-917	18 VAC	31	1A @ 12 amps.	3.25
R-965	24/30 VAC	38	1A 1B @ 1.5 amps.	1.95
R-966	24/30 VAC	38	2A 2B @ 1.5 amps.	2.25
R-967	24/30 VAC	38	2A 3B @ 1.5 amps.	2.40
R-968	24/30 VAC	38	1A 5B @ 1.5 amps.	2.55
R-969	24/30 VAC	38	1A 6B @ 1.5 amps.	2.70
R-974	24/30 VAC	48	1A 1B @ 1.5 amps.	2.25
R-971	24/30 VAC	48	1A 2C @ 1.5 amps.	2.40
R-973	24/30 VAC	48	2A @ 1.5 amps.	2.25
R-970	24/30 VAC	48	2A 1C @ 1.5 amps.	2.40
R-975	24/30 VAC	48	1B 1C @ 1.5 amps.	2.40
R-976	24/30 VAC	48	2C @ 1.5 amps.	2.55
R-977	24/30 VAC	48	3A 1C @ 8 amps.	2.70
R-883	115 VAC	1200	1A 1C 1D	2.00
R-853	6/8 VDC	30	2A @ 10 amps.	1.55
R-875	6/8 VDC	240	1A @ 12 amps. 1C @ 1.5 amps.	1.50
R-838	24 VDC	330	2A	1.45
R-832	24 VDC	375 C.T.	1A @ 15 amps.	1.70
R-959	24 VDC	747	2C	1.50
R-929	24 VDC	425	1A Dbl. Brk.	1.25
R-982	12 VDC	24	1A Dbl. Brk.	1.55
R-947	12/24 VDC	320	1C @ 3 amps.	1.25
R-906	24 VDC	95	1A Dbl. Brk. @ 20 amps.	1.55
R-926	24 VDC	95	4C @ 15 amps.	3.55
R-983	24 VDC	265	3A	1.65
R-984	24 VDC	375	1C	1.65
R-878	24 VDC	375	1C Micalex	1.65
R-871	18, 24 VDC	2000	2C	1.65
R-936	28 VDC	1000	1C @ 1.5 amps.	1.65
R-829	12/18 VDC	270	1A	1.45
R-905	32 VDC	1500	1C Dbl. Brk. @ 15 amps.	3.25
R-869	115 VDC	600	1A Dbl. Brk.	2.25
R-963	220 VAC	...	2C-1A Dbl. Brk.	7.50
R-528	35C MA	1.75	1C @ 6 amps.	1.25
R-953	12 VDC	65	1A @ 100 amps.	4.95
R-955	12 VDC	65	1B @ 100 amps.	4.95
R-954	24 VDC	160	1A @ 100 amps.	4.95
R-876	12 VDC	175	2A 1B	1.60
R-882	24 VDC	300	1A	3.30
R-860	48 VDC	3000	2A @ 1 amp. 230 v	2.60
R-923	24 VDC	1050	2C	2.75
R-958	60 VDC	1550	2A @ 12 amps.	1.50

W-E TYPE "E" RELAYS

Stock No.	Voltage	Ohmage	Contacts	Unit Price
R-910	...	6, 35/35	2A Split Cont.	$3.50
R-904	...	35/175	1A	1.25
R-981	12 VDC	270	2B-2C	1.50
R-870	24 VDC	2600	1A	1.30
R-863	48 VDC	4000	3A	2.00

SLOW ACTING

R-897	6 VDC	150	1A Slow Break	2.65
R-865	24 VDC	200	1C Slow Break	1.75
R-934	24 VDC	3000	2B Slow Break	2.95
R-962	6 VDC	150	1A Slow Make	2.65

DIFFERENTIAL RELAYS

R-849	220/250 VDC	8000	2C	3.65

SEALED RELAYS

R-861	32 VDC	8000	1B	4.00

VOLTAGE REGULATORS

R-986	6 VDC	...	3 Terminal	2.25
R-886	6 VDC	1	with 15 ohm 50 watt	1.95

CONTACTORS

R-890	24 VDC	60	1A @ 10 amps.	3.45
R-916	24 VDC	80	1A @ 25 amps.	2.95
R-885	24 VDC	126	1A @ 25 amps.	3.00
R-845	220 VAC	...	3A	6.95
R-838	90/120 VDC	925	2a	4.50
R-842	115 VDC	925	3A	5.50
R-840	115 VDC	1200	2A—Size 1	5.50
R-843	115 VDC	1200	3A	4.50
R-841	115 VDC	1200	3A-1A (Aux.) Size 2	40.00
R-844	115 VDC	1200	3A-1B (Aux.)	4.50
R-980	24 VDC	6	1A @ 250 amps.	5.50
R-942	24 VDC	80	1A @ 200 amps.	3.95
R-888	115 VAC	32	2A Dbl. Brk. Size 1	7.50
R-903	24 VDC	65	1A @ 200 amps.	5.50
R-938	24 VDC	70	1A @ 200 amps.	5.50
R-939	24 VDC	40	2A @ 200 amps.	7.50
R-854	24 VDC	100	1A @ 50 amps.	4.05
R-933	24 VDC	160	1A @ 50 amps.	4.75
R-881	24 VDC	150	1A	2.50
R-944	115 VAC	40	4A (1B-Remote)	4.50
R-943	115 VAC	100	4A-4B @ 10 amps.	6.75
R-941	14 VDC	12	1A @ 200 amps.	4.05
R-956	28 VDC	160	1A Dbl. Brk. @ 50 amps.	4.05
R-880	18, 24 VDC	375 C T	1A Dbl. Brk.	2.50
R-889	18, 29 VDC	180	1A Dbl. Brk.	2.50
R-899	24 VDC	70	1C @ 50 amp. 1B Aux.	2.50
R-898	28 VDC	8	1A @ 200 amps.	4.50
R-905	24 VDC	11	1A @ 250 amps.	5.50
R-937	24 VDC	150	1A @ 50 amps.	4.75

Stock No.	Voltage	Ohmage	Contacts	Unit Price
R-831	7.5/29 VDC	6.5	1A @ 250 amps.	$5.50
R-925	24 VDC	100	1A @ 50 amps.	4.05
R-940	24 VDC	132	1A @ 200 amps.	5.50
R-879	24 VDC	150	1A @ 50 amps.	3.75
R-874	24 VDC	140	1A Dbl. Brk. @ 25 amps.	2.00
R-945	12 VAC	1	2A @ 30 amps.	3.25
R-946	125 VDC	3200	2A @ 30 amps.	2.75
R-860	115 VAC	175	2A @ 30 amps.	5.95

MIDGET RELAYS

R-857	24 VDC	260	1D	1.75
R-912	4 5 VDC	20	3A-1C Ceramic	1.45
R-921	6.7 VDC	18	1A Dbl. Brk. @ 10 amps.	1.45
R-922	12 VDC	75	1A Dbl. Brk. @ 10 amps.	1.45
R-893	14 VDC	150	1A, 1C	2.50
R-895	14 VDC	150	2A, 1B, 1C	2.50
R-896	24 VDC	260	2A	2.50
R-894	24 VDC	260	3A, 1C	2.50
R-856	18, 24 VDC	300	1B	1.45
R-913	6 VDC	20	3A, 1C Ceramic	1.45
R-915	12 VDC	70	1A Dbl. Brk. @ 10 amps.	2.00
R-834	6 VDC	20	3A, 1C	1.45

SPECIAL RELAYS

R-846	5 8 VDC	19	1C Coax	6.95
R-926	6 VDC	18	1A @ 25 amps.	1.25
R-931	Min. 1.5 Ma.	150	1C	7.50
R-927	220 VAC	2500	1A @ 5 amps.	15.00
R-951	115 VAC	...	¾" Stroke	2.45
R-887	.5 Adj. 1.5 Amp.	40	2 Pole 2 Pos.	27.50
R-932	6 V @ 112 amps 12 V. @ 56 amps. 24 V. @ 28 amps.			4.25
R-930	25, 50 VAC	25 ea. coil	2B-1H @ 8 amps.	
R-972	40, 50 VAC		1A @ 12½ amps. 1B @ 12½ amps. 1 MBM @ 1½ amps.	3.75
R-256	26 VDC	65	2B-1A @ 1KW	10.95
R-906	40 VDC	600	1A @ 30 amps.	3.95
R-864	24, 24 VDC	95/95	1A,1B,1C/1A,1B,1C	5.50
R-847	10, 15 VDC	70	4C	4.75
R-964	220 VAC		2A Dbl. Brk. @ 3 KV.	8.95
R-952	24 VDC	175	1A-Grounded	2.95
R-884	12 VDC	670	2A	
R-902	28 VDC 115 VAC	230	12 Pos. Rotary 1A @ 25 amps. 440 VAC 1A @ 2 amps 300 VDC 1A @ 5 amps. 115 VAC	12.95
R-866	Adj. from 1 Ma.	6200	1C	17.50
R-957	12 VDC	.5	1B 2 Aux. Cont.	1.50
R-919	6, 8 VDC	50	1C	5.25
R-911	40 VDC	200	1C @ 20 amps. 1A Mom.	7.95

TYPE 82

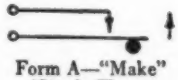
Stock No.	Voltage	Ohmage	Descriptive Information	Price
R-889	28 VDC	7	360° Rotation in 12 steps with 7" lg. shaft	$2.45
R-766	28 VDC	4/230	360° Rotation in 12 steps with 2½" lg. shaft and 8-6 Terminal Wafers mounted on 12" x 5" Terminal Board with 63 Screw Terminals plus lugs	4.90

ROTARY RELAYS Type 76-77 14 VDC—2 Ohm Energizing, 125 Ohms Holding Coil 30° Rotation ¼" Long Shaft.

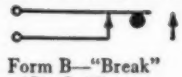
Stock No.	First Wafer Circuit 1	First Wafer Circuit 2	First Wafer Circuit 3	First Wafer Term*	Second Wafer Circuit 1	Second Wafer Circuit 2	Second Wafer Circuit 3	Second Wafer Circuit 4	Second Wafer Term	Price
R-877	1 NC	1 NC	...	4	1 NO	1 NO	1 NO	8PDT	9	$2.25
R-892	3 NO	...	...	4	8PDT	8PDT	Ceramic		6	2.40
28 VDC—7 Ohms Energizing, 230 Ohms Holding Coil 30° Rotation ¼" Lg. Shaft										
R-711	8PDT	2 pole reversing	...	8	With Coupling					2.05
R-712	1 NC	1 NC	1 NC	6	...	...	...	...	...	2.05
R-573	2 pole reversing	...	...	5	...	...	...	...	...	2.05
R-901	2 NO-1 NC	...	...	4	8PDT	8PDT	3 NC	...	10	2.25
R-616	1 NC	1 NC	...	4	1 NC	1 NC	1 NO		8	2.40

* NOTE: Number of terminals excludes those required for operation of relay.

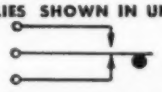
BASIC CONTACT ASSEMBLIES SHOWN IN UNOPERATED NORMAL POSITION



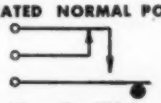
Form A—"Make" (Single Throw, Normally Open)



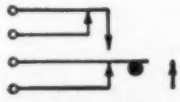
Form B—"Break" (Single-Throw, Normally Closed)



Form C—"Break-Make" (Double-Throw)



Form D—"Make-Before-Break"



Form E—"Break-Make-Before-Break"

WRITE FOR WELLS CATALOG

WELLS SALES, INC.

Telephone SEeley 8-4143

833 W. CHICAGO AVE. DEPT. R, CHICAGO 22, ILL.

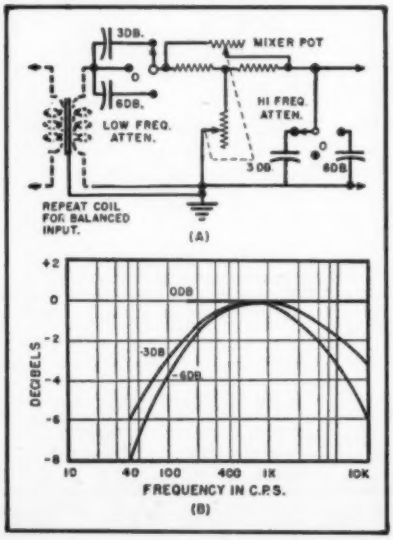
The music microphone is set for a flat response.

The voice filter in a ribbon velocity microphone consists of a reactor paralleled across the output winding of the microphone impedance matching transformer. This results in the low frequencies being slowly tapered off, beginning at 300 cycles, 100 cycles being down 5 db and 40 cycles, 15 db.

At times it may be necessary to reverberate music or dialogue. This may be accomplished several different ways; however, the accepted method is the use of an echo chamber as described in Part 4 of this series. The signal for the echo chamber is taken from the output of the preamplifier of the microphone to be reverberated. The signal is then fed to a power amplifier which, in turn, drives the speaker in the echo chamber. The reverberated sound from the chamber is fed to a preamplifier, an equalizer, a second preamplifier, and then to one of the mixer pots for controlling the amount of reverberation. The equalizer should be capable of increasing or decreasing either end of the frequency spectrum. Each type of program material reverberated will require a different type of equalization to secure the desired results.

Referring to the block diagram again, we now come to the mixer, employing 10 input positions and a master gain control. Each input is provided with high and low frequency attenuators. In the low frequency position two amounts of attenuation are available, 3 and 6 db at 100 cycles. The high frequency attenuation reduces 10,000 cycles 3 and 6 db. If greater amounts of attenuation are required, the losses may be increased to 6 and 12 db in other positions and patched in as re-

Fig. 6. (A) Low frequency attenuation is achieved by connecting capacity in series with input circuit and high frequency reduction by paralleling capacity across circuit. (B) High frequency reduction obtained at 10,000 cps by paralleling the input with capacity, 3 db with a .1 μfd. condenser and 6 db reduction with .2 μfd.



quired. Low frequency attenuation is achieved by connecting capacity in series with the input circuit and high frequency reduction by paralleling capacity across the circuit. The method used is illustrated in Fig. 6A. The design of such attenuators will be discussed in a future article in this series. If the input circuit of the mixer is 600 ohms. 6 db of attenuation at 100 cycles may be secured by the use of a .5 μfd. condenser in series with the input. For 3 db reduction, a 1 μfd. condenser is used. Three db of high frequency reduction at 10,000 cycles may be obtained by paralleling the input with a .1 μfd. condenser and 6 db reduction with .2 μfd. The frequency response for these values is shown in Fig. 6B.

It will be assumed for illustration that the mixer is an unbalanced parallel resistive network, using bridged "T" mixer pots. Mixer networks have two losses; one fixed by the network configuration and called the "insertion loss," and a second, a variable one, created by the setting of the mixer pot. For this example we will assume that the mixer pot is set to a position of 15 db loss and that the fixed insertion loss of the network is 20 db, which is approximately correct for a mixer of this design.

The input circuits of the mixer may be unbalanced as shown in Fig. 6A or repeat coils may be permanently connected at the inputs so that either balanced or unbalanced circuits may be connected, thus increasing flexibility. An output transformer should be included in the network to isolate the ground of the mixer from other devices, thus reducing the possibility of ground loops and allowing it to be used either with balanced or unbalanced circuits.

If it is assumed that a signal level of minus 10 dbm is applied to input 1, with the mixer pot set to 15 db loss (plus the 20 db insertion loss of the network), the level at the output of the mixer will be a minus 45 dbm. This level is fed to a booster amplifier with a gain of 30 db which raises the output level of the mixer to a minus 15 dbm which is applied to the input of a master gain control. The master gain control carries an average loss of 20 db and again reduces the signal level to a minus 35 dbm. A master gain control is necessary for over-all fades at the mixer console and it also provides an over-all control of the system gain.

This now brings us to the high and low-pass filters, each having an insertion loss in their passbands of .5 db. These filters will find their greatest use with film recording equipment, however, they will be quite useful at times for other types of recording. For recording a medium frequency range, the high frequency end should be limited by the use of one of the lower cut-off frequencies afforded by the low-pass filter. The 40 cycle high-pass filter may be left in the circuit at all times unless a higher frequency cut-off is required. This filter is useful in eliminating low frequency rumble and

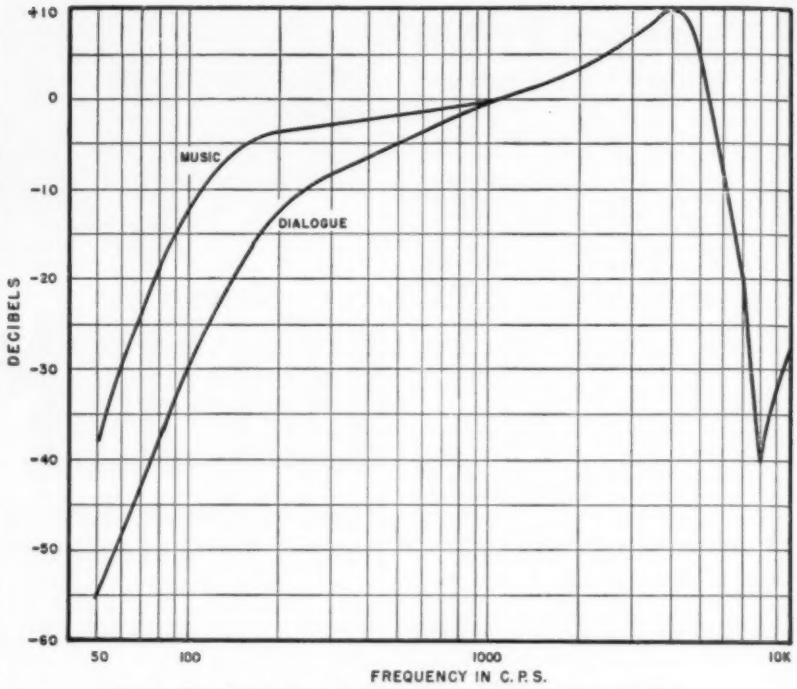
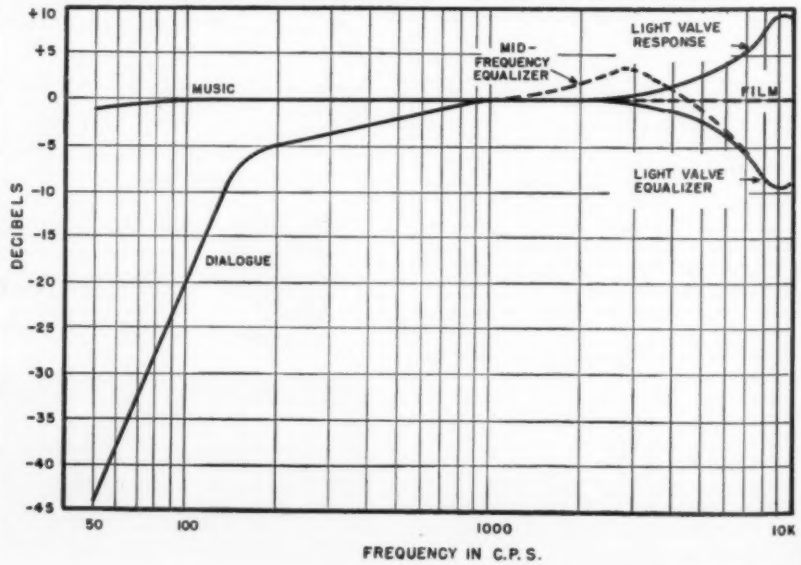


Fig. 7. Electrical frequency characteristics for 16 mm film recording.

building vibrations. For dialogue recording, an 80 cycle high-pass filter is substituted for the 40 cycle and at times a 120 cycle may be required. These filters may be designed with a switching arrangement for selecting the different cut-off frequencies, thus reducing the need for several units.

For dialogue recording on 35 mm film, it is the practice to use the high and low-pass filters with a "dialogue equalizer," which resonates in the mid-frequency range. The purpose of the equalizer is to introduce a certain amount of accentuation in the mid-frequencies to add "presence" to the dialogue. The amount of equalization will vary depending on the character of the voice and the type of microphone used. Mid-frequency equalization is particularly important when recording on 16 mm film because of the sharp high frequency cut-off employed. The electrical frequency characteristics for 16 mm film recording is illustrated in Fig. 7. It will be noted the high frequencies cut off at approximately 5000 cycles, and that the mid-frequency equalization has a rise of 7.5 db at 4500 cycles. Because of this

Fig. 8. For variable density recording, using a light valve, an equalizer having an inverse frequency characteristic of the light valve above 3000 cycles will be required in order to secure a uniform frequency response back from the film.



ARROW "The Home of Values!"

CABINET CH-118

Olive drab in color, this cabinet has a full length interlock access door on the rear. The front takes the standard 19" panels with 60 inches of height and 20 inches deep. It is shock mounted on a heavy steel platform and has a two-inch protrusion fully covering one side to accommodate wave trap and wiring. Louvered vents allow air circulation top and bottom.
Each F. O. B. Chicago..... **$34.50**

RA 52-RECTIFIER

A transtat controlled rectifier to produce high voltage DC from 110 VAC 60 cycle source. Up to 11,500 volts DC at 50 watts. Metered high voltage (0-15KV) and current (0-20 MA).
New..... **$74.50**

BC 768

Radio Receiver Chassis. Complete except for 13 tubes. This chassis with standard 19" panel front contains the receiver for 493.5 MC complete with power supply and an additional low voltage power supply that originally supplied the keyer BC 770 listed below.
110 VAC 60 cycles is the primary voltage.
Five 10 mfd—600 VDC oil filled GE condensers are used as filters. Five stages of 49 MC IF's.
Two of 10.4 MC, 6.3 VAC Transformer and of course power transformers—chokes and miscellaneous parts.
All units are in good condition as removed from new equipment. Even the salvage value is a great deal more than the low price of..... **$9.95**

BC-769 Transmitter P/O RC-100, less tubes..... **$6.95**

BC-770 Keyer P/O RC-100, less tubes..... **$4.95**

COMMAND (SCR 274 N) EQUIPMENT

	Used	New
ARA (same as command receiver) 1.5 to 3 MC, like new with tubes, less dynamotor, black crackle finish		$19.95
BC-455 6-9 mc receiver	$7.95	14.95
BC-457 4-5.3 mc transmitter	4.95	.....
BC-458 5.3-7 mc transmitter	4.95	.....
T-19 ARC 5, 3-4 mc transmitter	10.95	.....
T-22 ARC 5, 7-9.1 mc transmitter	7.95	.....
BC-496, 2 position Rec. Control Box	.....	1.95
MC-215 Mechanical Drive Shaft, per length	.....	2.45
BC-450 3 Receiver Remote Control	.89	1.95
BC-451 Transmitter Control Box	.....	1.50
BC-442 Antenna Relay, complete	.....	2.95
3 Receiver Rack	1.95	.....
2 Transmitter Rack	1.50	.....

MIKES and HEADSETS

HS 23 High Impedance Headset..... new **$4.95**
HS 33 Low Impedance Headset..... new **4.95**
CD-307 Ext. cord for HS 23-33..... like new **.59**
J41 Key..... new **.98**

T-32 Desk Stand microphone. Good used cond..... **$2.95**
Throat Mike—T 30—New..... **98c**
Lip Mike—Navy Type—New..... **98c**
Extension Cord and Switch Assembly for these Mikes—New..... **98c**

CW 49505

High impedance headset complete with leather headband and rubber cushions. Used. **98c**

AD-1 MOTOR

24 VDC—1/12 HP 6000 RPM
Intermittent Duty..... **98c**

PE 97 or PE117

Vibrator Power Supply for BC 620 and BC 659. Used—Less Tubes, Vibrator and Condenser..... **$2.95**

PE 120

Vibrator Power Supply for BC 620 and BC 659 with Tubes, etc.—Complete for 6 or 12 Volt operation..... Used **$6.95**

PE 218

Inverter, 24VDC input; output 115 VAC, 400 CPS at 13 amps. (1.5 KVA)..... new **$15.00**, like new **12.50**

CHOKES

10 Henry 20 MADC..... **29c** 4 for **$1.00**
10 Henry 50 MADC..... **39c** 3 for **1.00**

SCR 625 Famous Army Mine-Detector

For Prospectors, Miners, Oil Companies, Plumbers, Etc.
This unit is being offered now at a considerable reduction in price. Recently advertised at $79.50 it is now available in the same brand new wrappings in suitcase style carrying case (less batteries) at

$59.50
WHILE THEY LAST!

TUBES!

39¢

01A	1E7GT	2C26A	33		954
01B	1F4	3B7	34		1619
01C	1F5G	3D6/1299	38		1625
1A6	1G1	10Y	39/44		1626
1B4P	1G6GT	15R	49		
1B5/25S	1H4G	19	CRP 72		
1C6	1H6G	30 spec.	843		

49¢

2V3G	6T7G	12A6	12H6	77	
6J7G	6Z7G	12F5	12J5GT	211	957

69¢

0Z4A	CK1005	2X2	6L7G	6ST7	705 A
1A5GT		6J5GT	6R7GT	6W7G	

89¢

1B26	1S4	6AC7	6K8G	717A
1B32	2A4G	6AL5	6SH7	1613
1LD5	3S4	6C4	6V6GT	9002
1LN5	5W4	6K6GT	VR90	9003

$1.59

100TH	9.95	805	$3.29
304TH	14.95	807	1.89
304TL	14.95	813	9.95
307A	4.95	866A	1.69
803	2.89	872A	2.29
		830B	2.95

CATHODE RAY TUBES	3FP7..$1.95 4AP10. 1.95 5BP4....$3.95	5FP7..$1.95 5GP1.. 3.95	

MONTHLY SPECIALS!

BC-620 Transceiver, as is, less tubes. **$5.95**
PE-97 Vibrapack for BC-620, less tubes, vibrator and condenser..... **$2.95**
Both items (limited supply on hand)..... **$7.50**
BC-1066 Receiver . . . limited supply, less tubes, as is, fair condition..... **$2.50**

OIL FILLED CONDENSERS

.00025 mfd. 25,000 VDC, oil-filled, new..... **$2.95** ea.
1.75 mfd. 330 VAC, 60 cycle, G. E. Pyranol motor starting condenser with mounting bracket, NEW..... **59c** ea.

2 mfd	1000 VDC	59c	2 for $1.00
4 mfd	500 VDC	39c	3 for 1.00
1-1-1 mfd	1200 VDC	59c	2 for 1.00
.5 mfd	750 VAC	39c	3 for 1.00
.5 mfd	1500 VDC	39c	3 for 1.00
.25 mfd	600 VDC B.T.	24c	5 for 1.00
40 mfd	25 VDC Electrolytic	24c	5 for 1.00

50 mmfd 5000 VDC vacuum condenser, NEW..... **$1.29**

AM 61

Indicator amplifier—New with blower and all parts except tubes..... **$7.95**

VIBRATORS

2 Volt—7 Prong Synchronous... **69c** 10 for **$6.00**
6 Volt—4 Prong Non synchronous. **98c** 10 for **9.00**

BC 709

Battery operated lightweight interphone amplifier. Complete with tube and shock mount, but less battery. New..... **$3.95** ea.

AS-138/ARN

10 inch streamline loop as used with direction finding receivers. Fixed position, it is ideal for planes, boats, automobiles. New..... **$1.95**

COMPASS INSTALLATION

MN-26C—Remotely controlled commercial type navigation receiver. Freq. range 150 to 1500 KC in three bands. Has twelve 6 volt tubes, 24 V dynamotor and band switch motor, NEW..... **$39.95**
MN-28C Control box for above, New..... **$9.95**
MN-52 Loop control unit, New..... **4.45**
MN-20E Loop (manually rotatable), New..... **9.95**
Loop transmission cable 168" long, new..... **9.95**
MC-124 Mechanical cabling, New per lgth. **2.45**
IN-4D Left-right indicator, New..... **9.95**
Plugs, set of three, New..... **3.75**
Manual, covering complete set, New..... **1.95**

SCR 508 EQUIPMENT

BC 603 Receiver..... $24.95 Exc. Used
BC 604 Transmitter..... 12.95 Exc. Used
BC 605 Amplifier..... 4.95 New
BC 606 Control Box..... .95 Exc. Used
FT 237 Mounting..... 9.95 Exc. Used
MP 48 Mast Base..... 2.95 Exc. Used
MS Mast Sections..... .49 Exc. Used
TM 11-600 Tech Manual..... 1.95
Crystals, Set of 80..... 19.95

PE 206 INVERTER

24 VDC to **80 VAC** at 800 CPS **500 VA**..... Used **$3.95**

SCOTT HI-FI OUTPUT TRANSFORMER

Made for Scott Navy Receiver. Fully Potted. Primary 5000 ohms. Secondary: 600 ohms center tapped and 60 ohms center tapped with inverse feedback..... New **$1.49**

MISCELLANEOUS SPECIALS!

	Used	New
RA 10 DA Receiver	$17.50	$24.95
BC 347 Interphone Amplifier	.....	2.95
BC 442 Less Condenser	1.49	1.95
APS 13 UHF Antenna, Pair	.....	.98
I-97 Bias Meter	3.95	4.95
RL 42 Antenna Gearbox Motor and Reel	4.95	7.50
One Tube Interphone Amplifier—Small compact alminum case fully enclosed 2¼"x3¾"x5¾". Less Tube	.....	.79
40 Amps Circuit Breaker	.....	.59
Collins VFO Dial—5 calibrated ham bands form 3.2 Mc to 32 Mc; complete with pointer, gears, logging dial and flywheel. Scale 6" on 8" plate, each	.....	.95
I 82 F Five Inch 360 degree compass indicator and Selsyn receiver	.....	4.95
A-81-2 Transmitters Selsyn for I82 indicator (both I82F & Trans. Selsyn for $7.00)	.....	2.45
PE-101 Dynamotor	.....	$2.75
Thermal-converter Weston Type D, model 507, range .12 amp	.....	.59
BC-1023 Marker Beacon Receiver, complete with tubes, shock mount and instruction manual	.....	9.95
BC-923 27-38 MC. FM Receiver, complete with tubes	$24.50	.....
BC-924 27-38 MC. FM Transmitter, complete with tubes	19.95	.....
BC-684 27-38 MC. FM Transmitter, less dynamotor	19.95	.....
10 meter modification kit for BC-610	.....	3.95
SCR-183 complete 12 volt set with all coils, tubes, dynamotor and control units	.....	49.50
ARB Control Box	.....	1.95
ARR2 Control Box	.....	.89

TS-10 Sound powered phones.
Brand New, each..... **$9.95**
Used **$6.50** ea.

MN 26Y COMPASS RECEIVER

Twelve stage superhet covering frequencies of 150 to 325 KC; 325 to 695 KC; and 3400 to 7000 KC in three bands. These units are brand new but with Dynamotor, Band Switch motor and tubes removed. Schematic Furnished. While they last, ea.... **$4.95**

RECORD PLAYER

Original Government cost $150.00. Contains husky three tube Amplifier, Large PM Speaker and two speed (33⅓ & 78 RPM) 110 Volt AC and DC motor. In portable leatherette carrying case.
Good operating condition..... **$19.95** each
Or with repairs required, as is.... **12.95** each
Also available straight AC with one speed 33⅓ RPM motor.
Good operating condition..... **$17.95** each
Repairs required..... **11.95** each

Shipments FOB warehouse. 20% Deposit on orders. Minimum order $5.00. Illinois residents, add regular sales tax to remittance. Prices subject to change without notice.

ARROW SALES, Inc. Dept. N, 1712-14 S. Michigan Ave., Chicago 16, Ill. PHONE: HArrison 7-9374

cut-off at 5000 cycles, it is necessary to attenuate the low frequencies to secure the correct frequency balance. For music recording, the low frequency end is extended but the mid-frequency rise is still used. These frequency characteristics may be obtained by a combination of the dialogue equalizer, high and low-pass filters.

For 35 mm film recording, the mid-frequency equalizer resonates at 3000 cycles and is variable in steps of 1 db up to a maximum of 8 db. The amount of equalization required will be determined by the type of microphone, set conditions, and experience with the system. For either type recording, the equalizer is placed after the microphone preamplifier and ahead of the mixer.

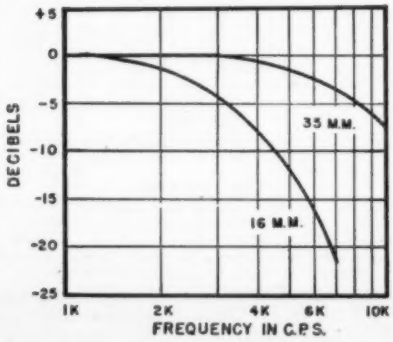
Equalization will also be required to compensate for the frequency characteristics of the light valve or recording galvanometer in the film recorder. For variable density recording, using a light valve, an equalizer having an *inverse* frequency characteristic of the light valve above 3000 cycles will be required to secure a uniform frequency response back from the film. See Fig. 8. If the system records variable area, it may or may not require compensation at the higher frequencies. This information may be secured from the manufacturer of the equipment.

To illustrate how such equalization could be inserted in our block diagram, the equalizer is shown connected between the output of bridging amplifier Number 2, and the input to the film recorder. No operating levels have been indicated, as they will be dependent upon the type recorder used.

Fig. 9 is a graph of the frequency response for typical 16 mm and 35 mm film recording systems. This data may be obtained by recording a series of constant-amplitude frequencies then measuring their amplitudes on the recorded negative with a micro-densitometer.

Leaving the filters we come next to the line or recording amplifier. This amplifier must have a low noise level, low distortion, and uniform frequency characteristics and be capable of producing an output level of at least plus 30 dbm (1 watt). For our illustration, this amplifier will require a gain of

Fig. 9. Frequency response for typical 16 mm and 35 mm film recording systems.



40 db. Following the line amplifier is a "limiter-compressor" amplifier. The type of recording to be made will determine whether this amplifier is to be set for limiting or compression. Compressors will be discussed in Part 7.

(To be continued)

Sweep-Marker Signals
(Continued from page 49)

scope. Typical response patterns marked by this method are pictured in Figs. 4C and 4D. This method of providing marks seems to have fewer disadvantages than any of the others, and has met with wide acceptance since its introduction several months ago.

1. Marks are stable, bright, and easy to look at for long periods of time.

2. Mark level is continuously adjustable and may be set at any convenient value for ease in viewing.

3. The mark is entirely independent of the set under test and is visible regardless of the state of adjustment or maladjustment.

The "Marka-Sweeps" and "Rada-Sweep" mentioned earlier are among the newest of the combination sweep and marker generators. These instruments employ the permeability variation method of obtaining sweep signal, and include crystal positioned marks of the independent pulse type. A combination block-schematic diagram of the "Marka-Sweep" I.F. model for television receiver alignment is shown in Fig. 5. This is an example of the newest circuit techniques employed in this still-growing field. –30–

RADIO CONTROL CONTEST

FROM Ted Houk, president of the Model Yacht Racing Association of America, comes word of an event of interest to those who build and sail radio controlled model boats.

On Monday, September 3rd (Labor Day), the Oregon Model Yacht Club will sponsor the competition for the Walker Remote Control Trophy at the Westmoreland Pool in Portland, Oregon. The trophy is valued at $500.

Persons desiring complete details on this contest are asked to write to R. B. Strange, secretary of the sponsoring group, at 7722 S. E. 16th, Portland, Oregon.

Skippers entering this event must be members of some club affiliated with the M.Y.R.A.A. For the name and address of the club nearest you, write to Leroy Gesbeck whose address is given below. He will also register the yacht as a DX-Class boat. The national registration fee is $1.00.

Mr. Houk points out that persons planning to enter models in this race should secure a copy of the regulations covering this competition from Leroy Gesbeck, national treasurer, at 7345 S. Blackstone, Chicago 19. The set of three rule books (Rating Rules, The Constitution and Regulations, and General Rules and Pond Sailing Rules) is $1.15. Recent additions and changes make it imperative to secure a copy of the latest rules. –30–

What's New in Radio

For additional information on any of the items described herein, readers are asked to write direct to the manufacturer. By mentioning RADIO & TELEVISION NEWS, the page, and the issue number, delay will be avoided.

HICKOK V-O-M

The Hickok Electrical Instrument Company, 10677 Dupont Avenue, Cleveland 8, Ohio has introduced a new battery-operated v-o-m, the Model 450, especially designed for field work of all kinds.

The large 5" lucite meter case provides good readability while the guaranteed unbreakable, shock resistant case protects the high sensitivity of this instrument. Sensitivity is 20,000 ohms per volt d.c. and 5000 ohms per volt a.c. Voltage ranges, both a.c. and d.c., are 2.5, 10, 50, 250, 1000, and 5000; d.c. milliamperes are measured in ranges of 2.5, 10, 50, 250, and 1000; d.c. microampere ranges are 0 to 50; d.c. amperes are 0 to 10. Decibels can be measured from –30 to +55 in five ranges. There are four ohm ranges: 0 to 1000, 0 to 10,000, 0 to 1 megohm, and 0 to 100 megohm.

The unit measures 5¾"x8⅜"x2½" and weighs 2¾ pounds. Test leads are supplied with the instrument.

SIGNAL GENERATOR

A new wide-range signal generator, the Model 706A, has just been introduced by *Radio City Products Co., Inc.* of 152 W. 25th Street, New York 1, New York.

This new instrument is said to provide high stability and accuracy in continuous coverage of 150 kc. to 220 mc. This is accomplished in 8 ranges, 6 being fundamental frequencies covering through 55 mc.

Accuracy is maintained within 1 per-cent of calibration. Adjustment and recalibration is possible by means of air trimmers. Thorough shielding of all critical circuits is provided, as well as for the components either individually or in compartments or both. This includes the oscillator tube, coil assembly, attenuator, and switching circuit. The transformer is electrostatically shielded.

Complete information on the Model 706A is available from the company on request.

B.C. LOOP ANTENNA

Grayburne Corporation, 20 South Broadway, Yonkers 2, New York is in production on a new broadcast radio loop antenna which combines high efficiency, high sensitivity, and omnidirectivity with low cost and small size.

Tradenamed the "'Ferri-Loopstick," the new unit features a "*Q*" of 240-275

and provides increased sensitivity and signal-to-noise ratio of receivers. The heart of the new antenna is its ferrite core formed by a special process to provide extremely high permeability. The unit measures only ½" in diameter and 2" in length.

Distributors and loop, coil, and set manufacturers may obtain free samples of the "Ferri-Loopstick" for test purposes by writing on their company letterhead.

NEW PILOT LIGHT

Industrial Devices, Inc., Edgewater, New Jersey is now manufacturing a new and improved low-cost pilot light known as the "Omni-Glow" Model 1010.

The new unit is a neon light encased in a nylon tube which slips through the mounting panel and is held in place with a special speed hut supplied with

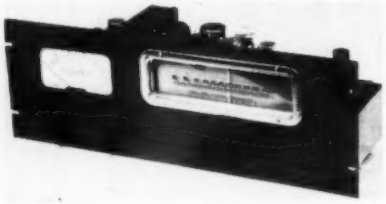
the unit. The lens is available in a wide selection of colors suitable to neon and features Fresnel lens for more even distribution of light. A polished metal collar connecting the lens and body provides an attractive trim on the operating side of the panel.

Operating on a voltage range of from 75 to 250 volts a.c. or d.c., the neon light withstands vibration and shock as well as voltage overloads that would ruin the usual incandescent pilot light. The new model is listed by *Underwriters' Laboratories.*

PROFESSIONAL FM TUNER

Collins Audio Products Co., Inc., P. O. Box 368, Westfield, New Jersey, has developed a professional-type FM tuner for precision work and special applications requiring quality performance.

The HP-14 uses 14 tubes and precise tuning is accomplished by means of a



4½" square meter. Permeability tuning is used in the FM front end. The output circuit may be operated directly into any load from 500 ohms to 500,000 ohms. The output level is approximately 3 volts, depending into what load the tuner operates.

The tuner has an automatic squelch which is available at the flick of a switch. The unit measures 19" wide, 8" deep, and 7" high and comes with a gray crinkle finish panel and a chromium plated dial escutcheon. A mahogany cabinet is available at extra cost.

CUSTOM RECTIFIERS

Barry Electronics Corp., 136 Liberty Street, New York 6, New York, has announced the availability of a line of custom-built selenium rectifiers which sell in the competitive price range.

Rectifiers from 1 to 24 amperes are carried as regular stock items for immediate shipment. Special or non-stock items can usually be shipped within 48 hours.

Inquiries on this custom line should be accompanied by complete details including the type of rectifier used, service for which the unit is intended, voltage, and intermittent or constant drain.

CRYSTAL DIODE

Berkshire Laboratories, 504 Lexington Road, Concord, Massachusetts, is making available to laboratories and electronic users its precision, high back resistance germanium crystal diode, the GCD-1.

Specifications on the diode include a continuous reverse working voltage of 80 volts maximum; peak back voltage for zero dynamic resistance of 90 volts

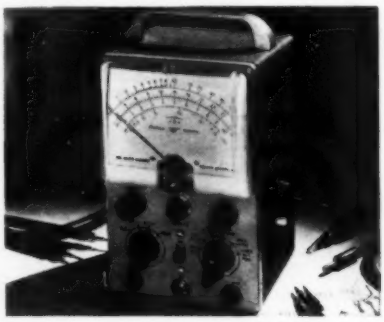
minimum; a forward current at +1 volt of 4 ma. minimum; average anode current of 40 ma. maximum; and recurrent peak anode current of 150 ma. maximum.

The ambient temperature range is from −50 to +75 degrees C and the average life is more than 10,000 hours. The diode will operate satisfactorily from d.c. to above 100 mc.

NEW V.T.V.M.

Heath Company, Benton Harbor, Michigan, is currently merchandising a new vacuum tube voltmeter kit, the Model V5.

Compact in size, the new unit features a 4½" streamlined meter of 200 microampere sensitivity, a two-color



meter scale for easy reading, six a.c. and d.c. ranges, and six resistance ranges covering from .1 ohm to over 1 billion ohms.

The kit comes complete with all parts including tubes, meter, transformer, test leads, and the cabinet. The accompanying construction manual includes step-by-step assembly instructions, pictorial diagrams, a schematic, and circuit description.

The company will supply full details on the Model V5 on request.

CORNER SPEAKER SYSTEM

The *Altec Lansing Corporation*, 9356 Santa Monica Blvd., Beverly Hills, California has released a new corner speaker system designed especially for home installation.

The new 820A is a full two-way speaker system built into a mahogany corner type cabinet. It is a counterpart of the company's theater speaker system which is currently in use in more than 7000 theaters in the United States.

The components of this system consist of a newly-designed direct radiating horn cabinet, an 808 multicellular horn, two 803 low frequency units, and an N 800-D 600 cycle crossover network.

ELECTRICAL STEEL

A new, thin electrical steel with unusual properties has been developed by *Armco Steel Corporation* of Middletown, Ohio.

Known as "Tran-Cor T-O-S," it can be operated at very high inductions, 20 per-cent higher than any nickel-iron alloy. The new material, thinner than most electrical steels, is intended for use in wound-type transformers and

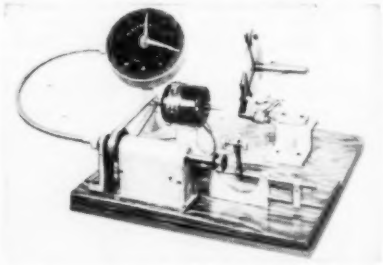
reactors which operate at 400 cycles.

The new material is supplied in only 4 mil thicknesses and in 12⅜" wide coils. It is surface treated on both sides by a special chemical and thermal processing to insure low interlaminar energy losses. The surface treatment is unaffected by annealing.

Full details on this new electrical steel are available from the company.

MINIATURE COIL WINDER

A new miniature coil winder for winding tiny, fine wire, random wound bobbin coils up to ¾" in width and 1½"



in diameter has been developed by *Geo. Stevens Mfg. Co., Inc. of* 6022 N. Rogers, Chicago 30, Illinois.

The Model 39 weighs only 26 pounds and measures 24" long, 12" wide, and 8" high. Permanent alignment is assured as the machine comes mounted on a steel plate. Winding speeds up to 5000 rpm are obtainable by means of a 1/25 hp. variable speed, series wound, a.c.-d.c. motor and foot operated speed control for 115 volt operation. A step-down transformer is available for 230 volt operation. —30—

BALLOON TRANSMISSION

HAMS Associated of Albuquerque, New Mexico will launch a free flight balloon carrying a v.h.f. transmitter which will automatically transmit a m.c.w. signal on 143.9 mc.

In cooperation with Air Force MARS the Albuquerque group is sponsoring this experiment on August 11th to arouse interest in v.h.f. activity, to obtain meteorological data, and to focus attention on the Air Force MARS program.

The transmitter (one or two watts' output) will be keyed at a slow speed to transmit the callsign of the HA-2, AF5QPK, followed by a four-letter code group for authentication. Battery life is expected to permit operation from 18 to 24 hours. Balloon height will be stabilized at 50,000 feet at which elevation it is expected to drift across the United States in a northeasterly direction. This should bring the balloon within range of many of the larger cities with their v.h.f. equipped stations and receivers.

Special QSL cards will be sent to all persons reporting the reception of signals from the HA-2. All persons hearing the balloon's signals are urged to report the time, location of receiver, signal strength, code symbol received, and any other data to Hams Associated, Tijeras, New Mexico.

The balloon will be launched between 7 and 8 p.m. (Mountain Standard Time) on Saturday, August 11th. —30—

PARTS and TUBES

ORDER from "PREMIER" Your reliable source since 1926

FREE! $20.00 List Value Cornell-Dubilier, Mallory, Aerovox, Sprague, Filter Condensers ------ Ten good filters FREE with each 100 tubes.

TUBE KITS

3Q4, 1T4, 1R5, 1S5.
List Value $8.00. Tube Kit only **$2.39**

3S4, 1T4, 1S5, 1R5.
List Value $7.80. 4 Tube Kit **$2.39**

1U4, 3S4, 1S5, 1R5.
List Value $7.80. All Four Tubes for **$2.39**

3V4, 1R5, 1S5, 1T4.
List Value $7.80. All for **$2.39**

117Z3, 1U5, 3V4, 1R5, 1T4.
AC-DC Portable Kit. All for **$2.89**

12AT6, 12BA6, 12BE6, 35W4, 50B5.
5 Tubes for **$2.95**

50L6, 35Z5, 12SQ7, 12SK7, 12SA7.
5 Tubes for **$3.22**

TV CONVERSION KITS

Convert 10" and 12" sets to 14"—includes 14BP4 Tube 70 Degree Deflection Yoke and Attractive Lucite Mask to eliminate all finish work on cabinet. Complete **$29.95**

17" CONVERSION KIT

Consisting of rectangular tube, 70 Degree Yoke, Beautiful Mask and Flyback Transformer. Complete **$37.95**

RESISTORS

Insulated ½ and 1 Watt assortment of most used values, best brands. ..... 50 for $2.25: 100 for **$3.95**

BY-PASS CONDENSERS

Tubular condensers. Nationally advertised brands. High Quality. Overstock sale price: **$5.00** per hundred

.001-600V
.002-600V

FILTER CONDENSERS

Close-out on all the cats and dogs on our shelves! You can substitute these for the more expensive filter condensers.

40/20—150/25V 30-30—350V
30/30—400/350V 30-30/25—400/25
20/40—450/400V 35-35—300V
35-35—300V 30-10/20—400/25
40/2)—250/25V 10/10/10/10/20—
20/20—300/25V 450/350/150/25

29¢ ea. While They Last

6 FOOT LINE CORDS

will be scarce—UL approved cord and plug—10 for **$1.95**

TWIN LEAD

55 Web virgin polyethylene, 300 ohm twin lead in either clear or brown ..... 1000 ft. $19.95
100 ft. 2.25

TUBES—Radio and TV

5c per Tube extra for less than 50 tubes
Individually Boxed —All Brands—Standard Factory Guarantee

45c ea.

5Y3GT
35W4
80
VT51
VT52

54c ea.

5Y4G
6AT6
6AV6
6J5GT
6SQ7
6X4
6X5GT
12AT6
12AV6
12J5GT
12SQ7
35Z4GT
35Z5GT
117Z3

59c ea.

0Z4
0Z4G
5U4G
5W4
5W4GT
6AR5
6BF6
6C4
6C5GT
6F5GT
6F6GT
6H6
6K6GT
6SF5
6SQ7GT
12BF6
12SQ7GT
25Z5

65c ea.

1A5GT
1H5GT
1U5
5X4G
5Z3
6AQ6
6BA6
6BE6
6H6GT
6Q7GT
6S4
6SF5GT
6SJ7
6SJ7GT
6SR7GT
6W4GT
7A6
7A7
7A8
7B4
7B5
7B6
7B7
7B8
7C5
7C6
7C7
7Y4
7Z4

65c ea.

12BA6
12BE6
12F5GT
12H6
12Q7GT
12SJ7GT
25L6GT
35A5
35L6GT
35Y4
35Z3
45Z5GT
50L6GT
50Y6GT

72c ea.

1N5GT
1R5
1S5
1T4
1U4
3S4
3V4
6AL5
6AQ5
6AS5
6AU6
6BC5
6BH6
6BJ6
6CB6
6SA7GT
6SC7
6SF7
6SK7GT
6S57
6U5
6V6GT
7A4
7H7
7Q7
12AU6
12SA7GT
12SF5GT
12SF7
12SK7GT
25W4GT
35B5
35C5
41
42
43
45
50B5
50C5
50Y7GT
75
77
78

79c ea.

1A7
2A5
3Q4
6A8GT
6B6G
6BC7
6BF5
6C6
6D6
6E5

79c ea.

6J7G
6K7GT
6SH7GT
6SN7GT
6U6GT
6U7G
6U6GT
7A5
7E6
7F7
7N7
7R7
7X6
12A8GT
12K7GT
12SC7
12SH7GT
12SN7GT
12SR7GT
14A7
14B6
14B8
14F7
24A
25Z6GT
35/51
50A5
50X6
85

87c ea.

3Q5GT
5V4G
6AK6
6BA7
6K5GT
6K8GT
6L7
6N7GT
6P5GT
6SL7GT
6Y6G
12AU7
12AX7
12BA7
12BH7
12SL7GT
14AF7
14C7
71A
117Z6GT
7193

95c ea.

1B3GT
1J5GT
1LA4
1LA6
1LC6
1LD5
1LE3
1LH4
1LN5
1P5GT
1Q5GT
1X2A
3LF4
5Z4
6AB5/6N5
6AG5
6AU5GT
6G6G
6L5G
6R7GT
6S8GT
7E7
7G7
7J7
7K7
7L7
7S7
7V7
7W7
7X7
12AH7GT
12AW6
12S8GT
12Z3
14C5
14X7
35Z6G

$1.04 ea.

6AC5GT
6AC7
6J6
6SD7GT
12AT7
19T8
25AC5GT

$1.04 ea.

25Y5
46
47
50C6G

$1.15 ea.

1H6G
2A3
6A3
6AB7
6AG7
6B4G
6B5
6B8GT
6BD5GT
6BN6
6BQ7
6C8G
6D8G
6F8G
6J8G
6S7GT
6T7G
6T8
7C4
7F8
12A7
12AV7
12C8
14F8
25BQ6GT
32L7GT

$1.40 ea.

5T4
6AH6
6AK5
6N6G
20
70L7GT
117L7
117N7GT
117P7GT

6BG6G	ea. 1.73
6CD6G	ea. 2.15
19BG6G	ea. 2.15
807	ea. 1.95
813	ea. 9.95

TV PICTURE TUBES

10BP4	$11.95	16JP4	$29.95
12LP4	$19.95	16RP4	$29.95
14PB4	$22.95	16TP4	$29.95
7JP4	$17.95	17BP4A	$31.95
		19AP4A	$44.95

Catalog of tubes and parts included with each order.

TERMS: 10% **DEPOSIT** with order, balance C.O.D. $1.00 handling charge for orders less than $5.00. All shipments F.O.B. Chicago. Our parts and tubes are warranted to be 100% replacements for the prototypes in the listings above. Prices are subject to revision without notice. SATISFACTION GUARANTEED. Illinois residents add 2% sales tax.
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Phone ANdover 3-1590

Spot Radio News
(*Continued from page* 18)

the facilities of experimental stations set up to produce test signals. Soon after this proposal appeared *General Electric* announced that they are planning a series of experimental color-casts using the composite system. Initially still pictures will be used, it was said, and later live programs will be transmitted, all tests being conducted at Electronics Park, in Syracuse, N. Y. Special field pickup receivers will be used for the study program.

The *G-E* announcement was followed by a statement from *RCA*, which disclosed that they, too, would conduct tests, and on an expanded basis, with the general public being invited to look in at compatible-color receivers set up in Exhibition Hall in Radio City. All sets are scheduled to feature use of the tri-color tube, which was announced at the hearings in late '50. With the release of color-test schedule, there also appeared the news that all of the company's licensees now had information disclosing how the tri-color tube was made and also how receivers using the tube can be produced. In fact, the licensees, of which there are over 300, also received complete kits of parts and color tubes, so that they might build pilot models, for lab and field evaluation. Even *CBS'* newly acquired set company, an *RCA* licensee, received the tube and chassis details. The latter incident prompted many to recall the blistering letter *RCA's* Prexy Frank Folsom wrote to FCC, regarding the release of the color tube to *CBS*. In that historic reply, Folsom said in part: "We were both shocked and surprised at your request, coming only a few weeks after your color decision. Already it is evident that your attempt to force an incompatible system on the American public has backfired. . . . Nothing, not even our tri-color tube, can remedy the basic defect of the system you adopted, namely its total inability to receive any picture whatsoever on the 9,000,000 sets outstanding in the hands of the public today. (Note: According to RTMA there are nearly thirteen-million receivers now installed.) . . . Your action in adopting standards for a system . . . which uses spinning discs, instead of an all-electronic system which requires use of color tubes, has disrupted and delayed our previously contemplated program for factory production and commercial sales of color sets and tri-color tubes. . . . In spite of the handicaps imposed by the FCC upon our program of experimental research, we are continuing that work with the objective of developing for the public the best tri-color tubes that can be made. . . . Until we have completed our research work, we will not be able to make models of our tri-color tubes available to others."

The bitterness, current in some plants, not only because of the green-light for motor-driven color, but because of extravagant promises made in some quarters, which it is claimed have caused sales slumps, raced through an important FTC session in Washington where more than one-hundred representatives of industry gathered to confer about trade practices and rules proposed by RTMA, NARDA, NTDA, and a picture-tube association. Particularly critical was Richard Salant of *CBS*, who during one point declared that the present definition of TV receivers ignores the color set, a comment which prompted *Emerson's* Prexy Ben Abrams to say that radio sets are still called receivers, whether they do or do not receive FM or short-wave, and TV sets would be considered as receivers, whether they were for color or black and white. Some did feel that a coined descriptive term might help in quickly differentiating between the two types of sight and sound sets. Shortly after this clash of words, Salant again rose to object to the RTMA rule which noted that it was not proper to declare in advertising that any set can be adapted to receive color broadcasts in black and white, unless there also appeared the statement that the resulting monochrome picture would contain . . . "materially less picture detail than a standard black and white broadcast picture." To this criticism Abrams also replied, declaring that the Commission had officially noted that the *CBS* system produced a . . . "degraded black and white picture." Salant angrily denied that such an interpretation appeared in the text, adding that perhaps the *CBS* picture had less geometric detail, but this did not mean an inferior picture. This remark prompted RTMA's new president, Glenn McDaniel, to state the *Columbia* picture was inferior because it presented about sixty per cent fewer dots.

Many pointed out that the sharp rejoinders at the FTC meeting reminded them of the barrage of verbiage which followed the FCC approval of the field sequential system, particularly the blast aired by RTMA's board chairman, Bob Sprague, who said that the manufacturers . . . "believed and still believe that the action (by FCC) was unwise." Pointing out that there were two reasons why it was believed that black and white pictures will continue to provide the best television entertainment for years to come, Sprague said then that first, it was industry's . . . "profound conviction, the FCC to the contrary notwithstanding, that the right kind of color television system simply isn't here yet." In addition, he pointed out, there is an equally firm belief that black and white television will never be obsolete . . . "even when a sound color system has been developed." Chiding the Commission and *CBS* for their lack of familiarity with manufacturing and sales, Sprague declared during his broadcast that neither have ever

sold radio and television to the public and thus the problem of converters or adapters was a bit foreign to them. Frankly, he said, he was more inclined to . . . "take the opinion of set merchandisers, who know by long experience that the public, especially the housewife, does not want any extra gadget or gadgets on her receiver, whether for radio or television." Describing the trend to larger sets, Sprague had pointed out that it is a . . . "fair assumption that only a very small percentage of present TV set owners will buy converters.

HEARINGS, during which FCC Headman Wayne Coy's reappointment to a new seven-year term was being considered, also teemed with comments on color. Particularly interesting were the personal views of Coy, who reported during questioning by the Senate Interstate Commerce Committee, that the Commission would have preferred a compatible system.

THE TV-AIR FREEZE, which it appeared was really ready for a genuine thaw, has again been iceberged, and this time through no fault of the Commission, but because of a brief issued by the Federal Communications Bar Association and a resolution introduced by Senator William Benton, the brief declaring that the proposed block allocations were illegal and the resolution asking for six-month to a year's delay to reconsider the freeze and the program proposed to remove the freeze, through an investigation by a Congressional committee.

The bar association move was considered so serious that Senator Edwin Johnson penned a long letter to Wayne Coy, which said that the legal points raised appear to be of . . . "such grave public interest, that I, as chairman of the Committee on Interstate and Foreign Commerce, believe it is my duty under the Congressional Reorganization Act to express my views . . ." If the Commission would consider the legality of its allocation plan, the Senator declared, and . . . "find that it is contrary to the provisions of the Communications Act as charged . . . vital time would be saved and the funds and the energies of the government and the applicants would not be wasted." The Senator pointed out that if . . . "the Commission's plan were merely adopted as a guide . . . for the development of a fair, efficient and equitable distribution of television service, applicants would have an opportunity to be heard for any channel without the necessity of first going through a rule-making proceeding . . . Under such a procedure the plan would not be vulnerable to adverse legal action." According to the committee chairman, television should become available as quickly as possible to those in areas long denied this privilege, and any doubts . . . "as to the legality of the Commission's proposal should be settled immediately to further this objective." . . . . L.W.

NEW TV PRODUCTS on the Market

ANTENNA ROTATOR

Walco Products, Inc. of 60 Franklin Street, East Orange, New Jersey is currently in production on a new television antenna rotator, the *"Walco* Rotenna."

The new unit supplies a guaranteed minimum of 50 inch-pounds of starting

torque from a small but powerful motor weighing less than 3½ pounds and measuring only 4" x 4" x 7½". It is equipped with a selsyn motor type dial indicator which shows the exact position of the antenna at all times. The indicator is easily calibrated at each individual location and small numbers are supplied loose and may be fixed to the dial face when each channel position has been established.

The rotator accommodates mast sizes from 1" through 1⅜".

CR SCOPE

Precision Apparatus Co., Inc., 92-27 Horace Harding Blvd., Elmhurst, Long Island, New York is currently introducing a new high-sensitivity cathode-ray oscilloscope, the Series ES-500A.

This new unit is a 5" laboratory type

instrument with extended range, voltage regulated, push-pull amplifier for multi-purpose industrial, AM, FM, and TV applications.

The Series ES-500A features response beyond 1 mc., 2 megohm input resistance, approximately 20 μμfd. input capacity, and regulated voltage for utmost stability. The better than 20 millivolt-per-inch vertical amplifier sensitivity permits direct alignment and/or adjustment of low gain circuits and examination of minute signal levels. The multivibrator type internal linear sweep circuit provides direct coverage from 10 cycles to 30 kc.

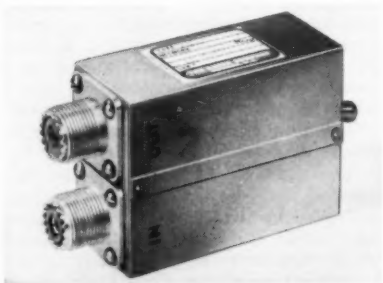
Literature and additional information on this new unit may be secured by writing G. N. Goldberger at the company address.

VIDEO ROLL-OFF NETWORK

The Daven Company, 191 Central Avenue, Newark 4, New Jersey has developed a new video roll-off network, the Type V-103..

This new unit is designed to provide the standardized bandwidth required when performing operating measurements. It meets all standards on television methods of measurement and is widely used in television stations and laboratories.

The frequency characteristics provide a 6 db roll-off at 3 mc. with reference to the low frequencies. The circuit provides a rise time of approximately .175 microsecond without overshoot. The circuit is a three-mesh, 73 ohm constant impedance network. A suitable switch is provided for straight-through operation which removes the network and restores the original wide-band characteristics of the scope. "In" and "Out" connectors are provided for inserting the network in the line.



U.H.F. TRANSMITTER

A new low-cost u.h.f. television transmitter, designed especially for the small town station, is currently undergoing tests at the *General Electric Company's* Electronic Park in Syracuse, New York.

The transmitter operates in the u.h.f. channels which have been proposed by the FCC for nation-wide expansion of television. Commercial stations are expected to start operation in these u.h.f. channels late in 1952 or early in 1953. A special antenna will be used with the transmitter to give it an effective radiated power of about two kilowatts.

The transmitter is designed to pro-

RADAR SETS
APS-2
APS-3
APS-4
APS-6
APS-6A
APS-10
APQ-13
APS-15
APS-31
CPN-8
CEXH
FD MK 4
MARK 10
SA
SC
SD
SE
SF
SG
SI
SK
SL
SM
SN
SO
SQ
SW
SCR 518
SCR 520
SCR 533
SCR 545
SCR 663


COMMUNICATIONS EQUIPMENT COMPANY — *for your needs*

DYNAMOTORS

Type	Input Volts	Amps.	Output Volts	Amps.	Radio Set	Price
PE86	28	1 25	250	.060	RC 36	$ 2.95
DM416	14	6 2	330	.170	RU 19	6.95
DM33A	28	7	540	.250	BC 456	4.95
DM42	14	46	515	.110	SCR 506	4.95
			1030	.050		
			2/8			
PE101C	13/26	12 6	400	.135	SCR 515	5.95
		6 3	800	.020		
BD AR 93	28	3 25	375	.150		4.45
23350	28	1 75	285	.075	APN-1	3.50
35CO458	28	1 2	250	.060		
ZA-885	12/24	4/2	500	.050		
ZA-856	12/24	8/4	12/275	3/110		
B-19 pack	12	9 4	275	.110	Mark II	8.75
			500	.050		
D-104	12		225	.100		12.69
			440	.200		
DA-3A	28	10	300	.060	SCR 522	8.45
			150	.010		
			14 5	.5		
5053	28	1 4	250	.060	APN-1	3.95
PE73CM	28	19	1000	.350	BC 375	
CW21AAX	13	12 6	400	.135		9.95
	26	6 3	800	.020		
			9	1 12		
BD 77KM	14	40	1000	.350	BC 191	12.95
PE94	28	10	300	.200	SCR	
			150	.010	522	
			14 5	.5		

REPLACEMENT DYNAMOTORS FOR DV12, DY13, ETC. OF ART-13. BRAND NEW.....$9.95

CAPACITORS CERAMICON

MMF.	MMF.	MMF.
3	35	82
3.1	47	125
4	50	200
11	51	240
13	60	250
14	62	345
15	65	350
20	70	500
220		1000
25		

$7 PER 100

SILVER MICA BUTTONS

MMF.	MMF.	MMF.
40	175	500
50	180	2000
100	185	

$7.50 PER 100

VARIABLE TRIMMER CONDENSERS

C890 15 MMF
C881 20 MMF
C993 50 MMF
C677 60 MMF
32c ea.

AN-GSC-T1 CODE TRAINING SET

Complete with 10 keys. Consists of a variable pitch audio oscillator powered by universal power supply. DC, 6-12-24-115V. AC, 115-230 V. Voltage selectable by switch. Has loudspeaker and volume control. Contained in carrying case 17 x 10¼ x 13". Ideal for code training groups, clubs, schools, etc. NEW original boxes. Were $60.00, now ea. $24.95

Tuning Units for BC375 & 191 Diag. for Conver to VHF Freq. Meter in Oct. 1950.

TU7	4500— 6200KC.	
TU8	6200— 7700KC.	
TU9	7700—10000KC.	
TU20	200— 500KC.	

Price $2.49 ea.

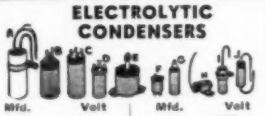
Tube Type Xtals

DC-8-D	8000KC	$1.00
DC-8-K	3500KC	1.00
	4000KC	1.00
	6200KC	1.00

Xtal Prongs ⅞" C to C RCA MI8412A. 1.00

4495KC	$1.00
3685KC	1.00

ELECTROLYTIC CONDENSERS



Mfd.	Volt	Mfd.	Volt
80	150	80	300
60	300	80	400
40	250	80	450
80	250	100	350
80	300	2x4	500
30	300	2x8	450
100	150	20-80	450-350
20-20	400-25	15-10	450
2x30	25	80-10	400
20-10	150	80-20	450-350
40-20	150-25	3x8	150
150-50	25	3x10	150
40	150	800	15
2x10	150	30	450
10-2x20	400-50	32	450
Price ....18c ea.		2x10	350
		2x15	350
		8	450
		20-10	350-300
2x20(60)	450(350)	2x15-20	350-25
2x30(20)	350	2x10-20	450-25
80-40(150)		2x8-10	35
	400(50)	Price .....29c ea.	
2x40(20)	350(25)		
20-10(50)	450(50)		
50-40	425		
Price .....49c ea.			

250-1000			80	500	
10-6			40	450	
2x15-1200			100	400	
150-1.6			90	450	
10-50-100			2x10	450	
350-100-50			2x20	400	
1000-500			2x30	350	
6			20-8	500	
1000			2x80	300	
Price .....69c ea.			40-10	450-350	
			40-35	450-350	
8	100	.18	80-20	450	
8	150	.18	80-10	450	
8	350	.20	3x16	350	
10	50	.18	8-50	450-50	
10	150	.20	40-50	400-300	
12	450	.23	40-10	475	
16	100	.20	90-10	350	
16	150	.22	30-10	450	
16	300	.30	50-40	450	
16	450	.40	90-10	350	
20	25	.10	40-18	450	
20	50	.15	2x30	350	
20	80	.18	16	450	
20	350	.30	2x10	450	
24	350	.30	20-10 (50)	450 (50)	
25	25	.10	20 (250-100)	150 (15)	
30	300	.30	80-50	450-50	
30	450	.30	2x8 (10)	450 (25)	
40	150	.22	10-15 (20)	350 (25)	
40	450	.40	2x16-25	450-50	
50	25	.22	2x10-20	450-25	
50	50	.25	10-10-20	450	
50	150	.30	Price .....39c ea.		
100	50	.60			
250	15	.50			
500	8	.60			
500	25	.75			
1000	6	1.20			
2000	6	1.35			
1200	1.5	1.10			

MINICAPS PIGTAIL

Mfd.	Volt	Price
2	50	$0.10
4	50	.10
4	100	.15
4	150	.10
4	220	.15
5	25	.10
5	50	.10
5	150	.10
8	25	.15

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MOBILES! C.A.P. C.D.I

6 V. DYNAMOTOR SUPPLY

	RATINGS OUTPUT	INPUT
Volts	450 VDC	6 VDC
Amps	350 MA	45A
	OR	
Volts	450 VDC	6 VDC
Amps	200 MA	22A

Originally designed for 14V. but mobiles over U.S.A. report ex. results on 6V.

Brand New, w/Filter Box, Starting Relay, Mounting Plate.... **$12.95**

Plugs, Set of 2.....$1.00
(With Dynamotor only)

AUDIO TRANSFORMERS

AT666	Input 6 ohms: 250K ohms	$0.79
AT SUB	Multimatch Subouncer 200 ohms 15K ohms C. T.:	
	100K ohms /20K ohms	.69
AT070	Input to Grid 250 ohms: 60K ohms Hi Fi	1.19
AT566	Input to Grid, 500 /200 ohms: 50K ohms	.95
AT227	Output to line, 7500K 500 ohms CT 200—5key	1.45
AT753	Output PP 6L6 to 300 /20 /12 /16 ohms 25 Watt	2.95
AT871	UNIV. Output, Hi Fi. Pri 20K ohms nec. 15/ 7.5 /5 /3.75 /1.25 /500 ohms	3.79
AT554	Interstage, 10K ohms: 250K ohms 15db Level	1.95
AT765	Input 600 ohms to 50K ohms	.79
AT707	Interstage ouncer 10K ohms: 125 /125K ohms	.79
AT449	Driver 5K ohm to 4K ohm PP6L6 to PP805 Class B	3.89
AT21	Dual XFRMR 300 ohms: 300 ohms and 600 ohms: 250K ohms	1.35
AT383	Output 8500 ohms: 19 ohms 25W	1.79
AT415	Output 18K ohms CT to line 125 ohms 175W	2.95
AT649	Input Line 500 ohms T Grid. 75K ohms	.79

MANY OTHERS

ARC 5 MODULATOR

MD7/ARC5 Plate Modulator w/ dynamotor complete w/Tubes 1—1235, 2—1625, 1—VR50. Good cond. Price....$6.95

BC456 Screen Mod. $2.25

BC 605 INTERPHONE AMPLIFIER

Easily converted to an ideal intercommunications set for office—home — or factory. Complete w/conversion diagram for 110V operation. **Brand New $4.49**

MOBILE MODULATION KIT

T-103	Mike to 6J5 grid.
T-102	6J5 to Modulators, PP 6V6 or PP 6L6.
T-104	Mod. Trans. PP 6V6 or PP 6L6 to 829, 832, or 2E26.

All components miniature, ruggedized, and hermetically sealed.
COMPLETE KIT & DIAGRAM...$2.98

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BC 433 Radio Compass, Used. Excellent Condition $29.95
ARC-5 Receiver Dual Control Box 1.19
Band Pass Filter UTC 70473.....2.25
Oil Condenser, 2 X .1 MFD—7000V 1.69
Selsyn Set 2 C78248, C78247, Differential .....Set 12.95
Mast Bases MP-23 .....2.95
Tinnerman Cable Clamps 2 S 2-34-5-6-7 .....100/ 3.95
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Gun Firing Solenoid, G 11.... 1.79
100 Amp. 50V Noise Filters... 1.19

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Fig. C

13- 15	220	$1.20
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26- 30	220	1.35
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43- 48	110	1.25
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53- 60	220	1.50
61- 69	320	1.60
64- 72	110	1.25
72- 87	110	1.25
75- 84	110	1.25
88-106	110	1.50
107-129	110	1.65
130-157	110	1.75
130-150	70	1.50
130-160	110	1.85
158-191	110	1.85
161-180	110	1.75
189-210	110	1.95
200-220	110	1.95
270-300	110	2.10
324-300	110	2.40
378-420	175	3.00
432-480	110	2.75
485-580	110	2.95

932 PHOTO TUBE

Gas Phototube having S1 response, particularly sensitive to Red and Near Infrared Radiation. Can be used with incandescent light source. Send for Data. Price..... 75c

UNIVERSAL OUTPUT TRANSFORMER

Amertran S41cor P R I : 20,000 / 16,000 / 5000 / 4000 ohms. Sec'l. 500 /15/ 7.5 / 5 / 3.75 / 1.25 ohms. 30 db. contin. Flat to 17,000 CY. w/Diag. & Inst. for 6 watt amplifier $3.79

MICA COND.

The condensers listed below are new, unmarked, tested for capacity. Mfg. by Solar.

XM Screw Type D 2500 VT		XM Screw Type D 1200 VT	
30	40¢		
50	40¢	38	35¢
100	40¢	40	35¢
250	40¢	50	35¢
1000	45¢	125	35¢
1150	45¢	140	35¢
1250	45¢	425	35¢
1700	45¢	500	35¢
2000	50¢	850	35¢
2900	50¢	1300	40¢
3000	50¢	1700	40¢
3500	50¢	2000	45¢
4000	55¢	2900	45¢
4450	55¢	4000	50¢
4750	55¢	4200	50¢
5000	55¢	4800	50¢
6000	60¢	5000	50¢
6900	60¢	5400	50¢
6950	60¢	5500	50¢
7000	60¢	6300	50¢
7400	60¢	6700	50¢
8000	60¢	6900	55¢
10000	65¢	8500	55¢
12000	65¢	10000	60¢
15000	65¢	11500	60¢
16750	65¢	16750	60¢
17000	65¢	30000	60¢
17250	65¢	32000	60¢
19700	70¢	35000	60¢
20000	70¢	38000	60¢
21000	75¢	50000	65¢
25000	75¢		
30000	80¢		

T.V. Transformer, 7" or 9" scope, 3000v /5MA. 720 vct /200MA, 6.4 / 8.7A, 6.4 /6A. 5 / 3A, 1.25 /3A, 115 V 60 cy input. Price $3.95

Transmitters 40 Watt Output These Famous V.F.O. Drivers Available

4—5.3MC. $5.95
5.3—7MC. $5.95
274N (ARC5) Used, Good Cond.

Heineman Ckt Brks for AC-DC operation.

AM
1510M 7 Amp
1614 80 Amp
1614 50 Amp
Price ea. $1.10

TRANSFORMERS

These XFRMRS are Army Spec. All Underrated.

Comb. Transformers—115V /50-60 cps input.

Item	H.V.	Amp.	Filaments	Price
CT-142	645VCT	.050	5V /2A, 6.3V /12A	$ 4.25
CT-825	360VCT	.340	6.3VCT /3.6, 6.3VCT /3A.	3.95
CT-076	600V	.100	2 x 12.6V /1	1.95
CT-626	1500V	.160	2.5 /12, 30 /.100	9.95
CT-15A	350VCT	.070	6.3 /.6, 6.3 /1.8, 3 lbs.	2.95
CT-071	110V	.200	33 /.200, 5V /10, 2.5 /10	4.95
CT-378	2300V	4 MA	2.5 /2	6.95
CT-367	580VCT	.050	5VCT /3A.	2.25
CT-721	550VCT	.100	6.3 /1, 2.5VCT /2	2.95
CT-99A	2x110VCT	.010	6.3 /1A, 2.5VCT /7A.	3.25
CT-91A	726V	.100	5V /3A, 6.3 /3.5	3.25
CT-441	50V	.200	5V /2.4, 5V /1.2	2.29
CT-403	350VCT	.026 MA	5V /3A	2.75
CT-931	585VCT	.036	5V /3A, 6.3V /6A	4.25
CT-610	1250	.002 MA	2.5V /2.1A, 2.5V /1.75A.	4.95
CT-131	350VCT	.026 MA	5V /3A	2.75
CT-866	330V	.065	6.3V /1.2, 6.3V /600 MA	1.75
CT-319	330VCT	.085	5V /2, 6.3 /7.5, 6.3 /3	3.25

Filament Transformers—115V /50-60 cps input.

Item	Rating	Each
FT-781	866 Trans. 2 x 2.5 /5A.	$ 2.25
FTG-31	2.5V /2.5, 7V /7A (Tape @ 2.5V /2.5A), 16 lbs.	9.95
FT-674	8.1V /1.5A	1.10
FT-157	4V /16A, 2.5V /1.75A	2.95
FT-736	2 x 6.3VCT /32-1.2A	1.49
FT-418	6.3VCT /1A, 6.3VCT /7A	1.95
FT-735	6.3VCT /5A, 6.3VCT /1A	1.79
FT-101	6V /.25A	.79
FT-738	6.3VCT /1A, 5V /2A	1.66

Plate Transformers—115V /50-60 cps input.

Item	Rating	Each
PT-976	Auto: 120VCT /10 MA	$ 0.69
PT-31A	2 x 300V /5 MA	.79
PT-46A	4080VCT N.L. 3% to 18" H x 6" W x 7" L 20 lbs.	29.95
PT-033	4150V /400 MA 11½ x 9½ W x 9" D 70 lbs.	49.95
PT-75-2	3780 /3446 /3112VCT /77 MA.	10.95
PT-28-1	4600VCT /.077	12.95
PT-403	Auto: 70V /1A	2.29
PT-160	1120VCT /770 MA, 590VCT /82 MA, 25 lbs.	24.95
PT-170	Auto: 156 /146 /137 /128— 71A	3.29
PT-139	42V /46V /50V /55V /15.2A 7½ x 7" Wx6¾" H	10.95
PT-31A	2 x 300V /5 MA	.79
PT-976	120VCT /10MA	.79
PT-67-1	62V /3.5A	2.95
PT-12A	280VCT /1.2A	2.95

T. U. for BCAR230 or 430
3.2—4MC
5—6.2MC
1.2—1.5MC
1—1.2MC
Price 95c ea.
4—5MC w/ 4495KC
XTAL $1.89 ea.

MAGNETRONS

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2J31
2J21 A
2J22
2J26
2J32
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2J39
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2J34
2J61
2J62
3J31
5J30
714AY
718DY
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720CY
725-A
730-A
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706

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MIN. ORDER $3.00

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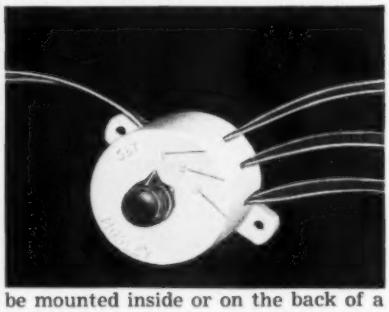
vide for higher power operation if the station owner desires to expand his coverage. This can be accomplished by the addition of an amplifier which would increase the effective radiated power to at least 100 kw.

TV ANTENNA SWITCH

Mosley Electronics of Overland, Missouri has developed a new three-position television antenna switch that can



be mounted inside or on the back of a television set, on the wall, baseboard, or windowsill.

Designated the No. F-20, the new unit is designed to provide efficient switching facilities in any TV installation where up to three antennas are used and where installation of a flush type is not feasible.

The new unit consists of a special constant impedance rotary switch employing low resistance silver-to-silver contacts on phenolic insulation and enclosed in a molded plastic case. Switch positions are clearly marked on the face of the unit and leads of standard 300 ohm transmission line are brought out of the case for easy connection to the set and to the three antenna transmission lines.

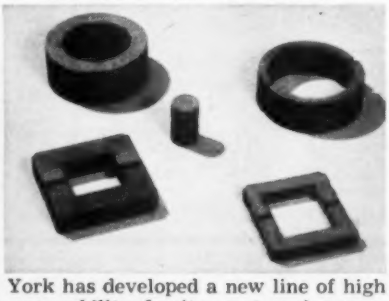
ALUMINUM TOWER

Alprodco, Inc. of Kempton, Indiana and Mineral Wells, Texas is in production on a new large diameter aluminum tower that will accommodate all popular rotators internally.

A special rotator adapter kit is now available as an accessory to this tower or an adapter plate can be purchased singly. A 22 per-cent increase of strength over the older model tower is claimed and technicians will appreciate the fact that steps are now included as standard equipment.

NON-CRITICAL FERRITES

Ferroxcube Corporation of America, 50 East 41 Street, New York 17, New



York has developed a new line of high permeability ferrite parts using non-critical materials.

Transformer cores, deflection yoke cores, antenna cores, and permeability tuning cores for television and electronics are now available in *Ferroxcube* 3 and 3C materials, which are nickel-free.

Complete technical information on these materials is contained in Engineering Bulletin FC-5101, available on letterhead request.

NEW TV TUBE

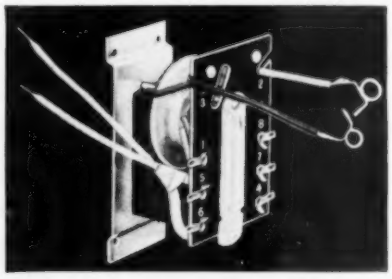
American Television, Inc. of Chicago, Illinois, has announced a new and less costly television picture tube, developed under the direction of Dr. Lee de Forest.

The new tube incorporates an unusual focus which eliminates the expensive magnet thus saving two pounds of copper and several pounds of steel per set. This special tube also features corrective contrasts which means that the tube will provide contrasts that are not inherent in the set itself.

This image-orthoscope is being used in the receivers being produced by one manufacturer at the present time.

FLYBACK TRANSFORMER

RAM Electronics, Inc., South Buckhout Street, Irvington-on-Hudson, New York has recently announced the



availability of its new Model XO53 flyback transformer.

Specially pattern-wound, the new unit generates 16 kv. for both the regular deflection and the new electrostatic deflection picture tubes, up to and including the 20" size.

According to the company, the new XO53 provides excellent regulation and linearity control and needs no special width and linearity coils. Even at maximum operating voltages the new unit is said to produce no Barkhausen oscillations, ringing, whistle, or corona.

The company will supply complete details on request.

4-ELEMENT BEAM

JFD Manufacturing Company of 6101 Sixteenth Avenue, Brooklyn 4, New York has added a new series of 4-element yagi television antennas to its line of TV equipment.

Incorporating twin directors, collector and reflector elements, cut to exact channel wavelength, the new yagi provides good forward gain, sharp horizontal directivity, and reduced interference.

These new antennas also incorporate the company's "Quik-Rig" feature

which permits the elements to be snapped into place and tightened for immediate assembly. A stepped-up driven element provides a direct match to 300 ohm impedance.

Illustrated literature describing these and other antennas in the company's line is available on request.

ION TRAP

The Indiana Steel Products Company, Valparaiso, Indiana has an-

nounced a new ion trap which has been tradenamed the "E-Zee-On."

The new unit possesses a uniform field pattern and can be adjusted in the matter of seconds with one hand. It is a slip-on, grip-snug beam bender made of one-piece, permanently magnetized Cunife that can't be put on backward and requires no manual clamping.

A descriptive folder on the new ion trap is available from the company.

BUILT-IN FOCUS

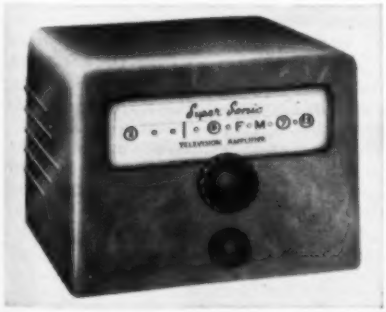
Development of a new cathode-ray picture tube incorporating 100 per-cent built-in automatic focus has been announced by the *Allen B. Du Mont Laboratories, Inc.* of Clifton, New Jersey.

The new tube eliminates the need for a focus coil, a focus control, or other focusing mechanism presently used in all existing types of magnetic and high voltage electrostatic cathode-ray picture tubes.

A new type of electron gun which eliminates external focus attachments is the heart of the new tube. Pilot production has already started on the new tube.

TV BOOSTER

Sonic Industries, Inc., 221 West 17th Street, New York, New York is currently in production on a new television booster, the Model IT 7.



Retailing in the moderate price class, the new unit is said to deliver a high usable gain with full bandwidth and high signal-to-noise ratio.

Complete information on this new unit is available from the company.

24" TUBE CHASSIS

Video Products Corporation of 2061 Broadway, New York 23, New York has recently introduced a new television chassis which is designed for custom installations.

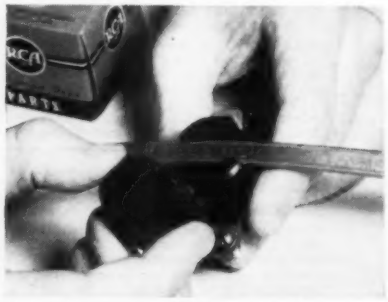
The new version of the 630 chassis has been designed for use with the 24

inch cathode-ray tube. Designated the Model K24, this new 30 tube chassis incorporates all of the features of the standard 630 plus the additional high voltage of 16 kv. for increased brightness and contrast range. A new full focus yoke is provided for sharp edge-to-edge focus.

LIGHTNING ARRESTER

A new lightning arrester designed for outdoor as well as indoor use has just been developed by the Tube Department of *Radio Corporation of America.*

An inexpensive plastic and metal de-



vice, the new 215X1 is designed to match 300 ohm line without cutting or splicing the line.

BRIGHTNESS TESTER

Photovolt Corporation of 95 Madison Avenue, New York 16, New York has developed a video brightness tester for measuring the brightness of television tubes, screens, and cathode-ray tubes.

The new Model 205 was designed for laboratory tests, production control, installation, and servicing. When the photocell is held to the face of the tube, the instrument indicates the brightness directly in foot-lamberts. The range extends to 100 foot-lamberts, thus covering the highest brightness values encountered. The 4" scale length is expanded for accurate measurement of low brightness values, 20 foot-lamberts being approximately at mid-scale.

The entire instrument is built into a portable wooden housing measuring 6½"x7½"x3½". —30—

Within the Industry

(*Continued from page* 26)

New York as a successor to the **WARSAW BUTTON COMPANY.** The firm will expand its production of control knobs for radio and television receivers and add new products from time to time.

* * *

AMPEREX ELECTRONIC CORPORATION has announced plans to build a modern one-story steel and concrete building on a recently-acquired tract on Duffy Avenue, Hicksville, Long Island. The additional facilities will be used for the manufacture of tubes . . . **WALTER L. SCHOTT COMPANY** recently opened a new plant at 3224 Exposition Place, Los Angeles, with appropriate ceremonies. The new facility provides 31,000 square feet of production space for the manufacture of the company's line of radio and television parts and antennas . . . **EUTECTIC WELDING ALLOYS CORPORATION** has completed a modern administration building at its Flushing, New York location in which the offices of the company, its various branches, and the *Eutectic Welding Institute* will be housed . . . **JFD MANUFACTURING COMPANY** has purchased a new site in Brooklyn for the construction of a new 120,000 square foot plant. The facilities will be used for expanding the company's production of television parts and accessories . . . **MODULATION PRODUCTS COMPANY** has moved to new and larger quarters at 56 Lispenhard Street, in New York . . . **LENKURT ELECTRIC CO.,** San Carlos, California, has recently completed a new 19,000 square foot addition to its factory and laid the foundations for 30,000 square feet of additional manufacturing and warehouse facilities . . . The **GRAYBAR ELECTRIC COMPANY** has opened new Eastern district headquarters at Bridge Plaza North and 21st Street in Long Island City . . . **I.D.E.A.,** manufacturers of the "Regency" booster, is building a new factory in Lawrence, Indiana which will house laboratory and office facilities as well as production assembly lines . . . **RADIO CORPORATION OF AMERICA** has opened a new tube manufacturing plant in Cincinnati, Ohio. The plant is dedicated to the memory of John G. Wilson, late executive vice-president in charge of the **RCA VICTOR DIVISION** . . . **SYLVANIA ELECTRIC PRODUCTS INC.** will build a new metallurgical laboratory at *Sylvania Center,* the company's 57 acre research site at Bayside, Long Island.

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Round-The-World

(*Continued from page* 37)

just a big powerful modulator. We also have a smaller modulator called a GM8 which combined with the 12-ACX transmitter gives an 800 watt, two-channel telephone combination. In Canada and in Bermuda there are some Canadian *Marconi* transmitters of 5 kilowatts' power which are of the same type as the *Federal* FTR-3 and the *Wilcox* 96-C.

On the ground we have two basic types of receivers. One is the single channel fixed-frequency receiver. There are several kinds of these including the *Collins* 5IN2 and the *Wilcox* type F-3. The other basic type is a modified tunable receiver which has a crystal locking in the oscillator to provide frequency stability. We have modified a number of *National* NC 240 receivers in this manner. We have tuned plug-in operation for the crystals so that we can lock the receiver on any frequency within its basic range. We always provide a separate receiver for each frequency to be covered at each station. In case of failure any receiver can be set-up on any frequency as long as crystals are available. However, at all the new stations we are installing the newer single-channel, crystal-controlled receivers.

There are three aircraft transmitters used by *Pan-American* in the Round-the-World Voice Radio System. One is the transmitter section of the *Collins* 18S transceiver, which covers 20 frequencies between 2 and 20 mc., and, like the aircraft receivers, is remotely controlled from the cockpit. The *Collins* 18S is a 100 watt transmitter.

Another transmitter in use is the *PAA* 100AX12. This is a 12 channel, 24 frequency unit which has a motor-driven turret mechanism very similar to the ACR 24 receiver. Power is 100 watts with a frequency range from 2-20 mc. We also have a number of the old *Collins* military transmitters, type ART 13. This transmitter was originally a ten-channel job, automatically tuned and self-excited. We modified it to crystal control for 20 frequency, ten channel operation. The crystal section is removable and a new set on 20 frequencies can be installed and the transmitter retuned by a good radio mechanic in about 20 minutes.

The aircraft receivers were of several types but we have now standardized on two receivers. One is an ACR-144 receiver which was designed by *Pan-American*. The original receiver covered 24 frequencies, crystal-controlled, and had a frequency range from 2 to 20 mc. It's all in a 1 ATR size box about 8" high, 10" wide, and 18" deep and has a motor-driven turret system which selects the proper coil and crystal system for changing frequencies. The first modification of this receiver provided three crystals in each channel which gave us a maximum of 72 frequencies as long as the

frequencies set up in each channel did not vary by more than 3%. We are now modifying all receivers to accommodate six frequencies in each channel. The other receiver used is a ten channel, 20 frequency unit which is a part of the *Collins* 18S transceiver.

As the system has expanded we found that we had to provide airborne equipment which would accommodate a large number of frequencies. Most of the aircraft equipment available had a maximum of 20 frequencies, so we designed new receiver equipment which would cover as many as 144 frequencies. We are now designing transmitting equipment that will accommodate up to 144 frequencies. Meanwhile we have an interchangeable crystal holder which fits into the 20 frequency transmitter and which can be changed quickly.

The results of the Round-the-World Voice Radio System to date have been highly satisfactory. Direct communication between the pilot of the aircraft and the ground station has increased both the speed and clarity of transmission.

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BALTIMORE HAMFEST

THE Fourth Annual Hamfest Picnic of the Baltimore Amateur Radio Communications Society will be held on August 19 at Triton Beach, Mayo, Maryland.

Tickets will be $1.00 per person at the gate and includes bathing, bath locker, picnic table, pavilion, parking lot, and ball field privileges.

The club station, W3PSG, will be in operation on 10 meter phone for the benefit of mobile hams and a special prize will be awarded for the best mobile installation.

For further information on this hamfest write Chairman Ernie Dobos, W3JCL, 2203 Fulton Avenue, Baltimore 17, Maryland.

-30-

When the Sprague Electric Company of North Adams, Mass., recently celebrated its 25th anniversary, three generations of Spragues were on hand for the cake-cutting ceremony. Robert C. Sprague, president of the company and chairman of the board of the Radio-Television Manufacturers Association, serves the first slice to his grandson, Robert C. Sprague III, while his son, Robert C. Sprague, Jr., steadies the boy's hand. Participating in the ceremonies are Vice-President Julian K. Sprague and Miss Mollie Avery, assistant secretary of the company and its first employee.

International Short-Wave

(*Continued from page 56*)

now called "A Voz do Brasil" and is radiated over *all* Brazilian stations 1730-1800 daily *except* Sun. *Radio Tupi*, Rio de Janeiro, ZYC9, 15.364, QSL's *only* if an IRC is enclosed; has nice card; a *new* oscillator stage is under construction and soon ZYC9 should be on 15.37 again. *Radio Brasil*, Campinas, state of Sao Paulo, has moved from 2.46 to 4.755; call is ZYY3; 1 kw. (Serrano, Brazil)

Timbiras, Maranhao, ZYY9, 4.975, noted 1730 with "Voice of Brazil" program (presumably is in Portuguese—KRB). Difusora de Manaus, Amazonas, ZYS8, 4.955, heard 2007 with strong level. Tamandare, Pernambuco, noted on 3.265 with Brazilian music, strong signal but with CWQRM; call not known. (Dyrektor, Brazil) Recife, 9.565, noted with "Brazil Calling" (*English*) week-days 1900-1915, good level. (Young, Ky.) PRB9, 9.505, *Radio Record*. Sao Paulo, heard 0415. (Machwart, Mich.)

British Honduras—No sign lately of Belize, 4.96, around 1800-1930; only QRM and QRN noted there. (Pearce, England; Bellington, N.Y.; Stark, Texas) This one may have been a "clandestine" or "pirate" outlet.—KRB

Bulgaria—Radio Sofia's new high-powered transmitter on 15.33 noted with news 1500 and 1600 (probably for Europe) but announced as on a wavelength of 49.42 meters (6.070). (Fried, Mich.) Also has *English* for North America 2000-2015, 2300-2315. At other periods during the evenings (*EST*), relays *Radio Moscow's English* broadcasts to North America. (Bellington, N.Y.; Balbi, Calif., others) Noted signing off 2315 and announcing 19.57 m. (15.33). (Nichols, W. Va.) Good on West Coast 2300 news period. (Balbi, Calif.) Asks for reports to Radio Sofia, Foreign Language Service, Sofia, Bulgaria. (Bellington, N.Y.) *Radio Sweden* reports the new transmitter on 9.700 in Turkish 1100; on 6.070 at 0000 in Bulgarian.

Canary Islands — EA8AB, Radio Clube Tenerife, approximately 7.515, heard 1650; clock chimes hour and call is given 1700; noted another day signing on 1610. (Pearce, England)

Cape Verde Islands—CR4AA still noted near 5.928 at 1645; signs off 1800 with "A Portuguesa." (Pearce, England) In recent verie, listed schedule as 1530-1700. (Ferguson, N.C.)

Ceylon—The Commercial Service of *Radio Ceylon* now is relaying *"Voice of America"* programs in Urdu and Hindi 0730-0830 and programs in *English* for South Asia 1030-1100 on 7.190, 11.975. (*WRH Bulletin*) Confirmed by Pearce, England, who has heard these broadcasts; mentioned a 16-m. outlet as parallel (probably 17.730 or 17.770).

Chile—CE1180, 11.998, noted at fair level 1930 with news in Spanish. (Dyrektor, Brazil) CE1515, 15.15, Santiago, noted with fair level but occasional fading 2000. (Gay, Calif.) *Radio Emisora Nuevo Mundo*, 11.74, Santiago, heard with news in Spanish, excellent level, around 2000-2100. (Hoogerheide, Wisc.)

China—Radio Peking has *English* broadcasts now 0430-0500, 0835-0900, 1700-1730 on one or more of these channels—15.060V, 11.685 (announced 11.690), 10.260, 6.100 (and possibly 15.170). (Morales, La.; others) The 0835 news normally is *not* carried over 6.100, 10.260. (Dilg, Calif.)

Here is late data from Dilg, Calif., on Communist Chinese outlets—6.100, Peking, scheduled to 1100, good level; 6.320V, heard 0630 to *after* 0900, good level; 6.390, Sian?, heard 0630 to *after* 0900, fairly good; 6.420A, possibly Hankow, heard around 0800, fair; 7.100, Harbin (Manchuria), audible to 0630 and later, weak; 7.145, Kunming?, weak, usually "smothered" by Taiwan, heard around 0900; 7.500, North Shansi?, heard around 0700-0900, fair; 7.670A, may be Mukden (Manchuria), heard around 0700-0930, fair; 10.260, Peking, does *not* carry *English* 0835 but usually does at 0430, signal better than 11.685 or 15.060; 11.685, Peking, *English* 0835, announces frequency as 11.690, on West Coast signal on 11.685 usually is better than on 15.060 which parallels; 15.060, Peking, carries *English* 0830, signal erratic at present.

Cuba—COBZ, 9.030, sent QSL card from P.O. Box 866, Havana, Cuba. (Kroll, N.Y.) Regarding a report in the May issue of *Short Wave News*, London, about a station testing as "CML, The Voice of Cuba," on 7.911, Sklenar, Havana, writes: "Haven't heard a station with that announcement, but one of CMQ's outlets *does* operate on about that channel and announces as 'C-M-Q (*say-emmy-koo*) desde Radio Centro, La Habana.'"

Czechoslovakia—Prague noted with *English* 1600 on 11.875 (best) and 9.55. (Bellington, N.Y., others) And with *English* 1930-2000 on 9.550 (Young, Ky.; Patterson, Ga.) Also noted parallel on 11.875. (Chatfield, N.Y.; Stauhs, N.J.) Noted closing *English* session 1430 on 11.840, fair level, some QRM. (Fargo, Ga.)

Denmark—Due to adverse atmospheric conditions, Copenhagen has revised its North American schedule; broadcasts now are only 45 minutes in length (first 30 minutes Danish, last 15 minutes *English*); is scheduled 1630-1715, 15.32; 2030-2115, 2145-2230, 9.52. Station officials state—"It is our hope that this new schedule will facilitate the reception of the Danish broadcasts, and here at Radio House we shall be very grateful for all kinds of comments and suggestions as to the reception of our programs." (Wadhams, Calif.) Copenhagen's weekly DX session normally is on Tuesday evenings (*EST*), but on occasions has special program then, in which case the DX program is deferred to Wednesday. (Bellington, N.Y.)

Egypt—SUX, 7.867, Cairo, heard with Arabic musical program from

1450 to closedown 1630 after Arabic news. (McWalter, Scotland)

France—English programs (presumably for Europe and British Isles—KRB) are scheduled from Paris this summer 0300-0315, 6.145, 7.240; 1345-1400, 1500-1600, 6.200, 7.280. (Catch, England) Paris, 17.85, has news in French 1215 sign-on to 1230. (Cox, Dela.) Noted with *English* on 6.200 at 1500; and signing off in French with "La Marseillaise" 1030 on 15.39.

Pearce, England, believes the station on 9.755 with Arabic news 1515 and with call "Hunas Francesa" at 1530 is Paris. Do not confuse with *Radio Omdurman,* 9.746A, Anglo-Egyptian Sudan, whose last Arabic broadcast is heard by Pearce, others, 1400-1430 sign-off.—KRB

Germany—Noted Hamburg, 7.29, in dual Osterloog, 11.795, recently with Swiss or Bavarian-type music 2335; 7.29 was best signal, but "sounds" like is using more than 400 watts (listed) on the 11.795 outlet; verification received for Osterloog channel. (Bellington, N.Y.) Latter noted in Texas by Stark *after* 2300.

By this time, *RIAS* (U.S. Sector of Berlin) should have a *new* transmitter in operation—in either the 42- or 41-m. band; schedule should be 2200-2005 daily. (ISWC, London)

Greece—Still noted on 11.717A at 2000 to North America with news in Greek; news in *English* varies at around 2035 to 2040. (Fargo, Ga., others)

Pearce, England, has noted a Greek station on approximately 8.010 with recordings to 1630 closedown. He notes that Larissa, 6.745, does *not* have *English* some Thursdays as scheduled (1530-1540).

Greenland—Gronlands Radio, Godthaab, verified recently with attractive QSL card. (Bellington, N.Y.; Oskay, N.J., others)

(*Continued on page* 119)

GUILD EMBLEMS

THE Radio and Television Technicians Guild of Florida, Inc. is currently issuing a distinctive emblem (Fig. 1.) to its members and conducting an intensive advertising campaign to familiarize customers with the symbol.

Co-op advertising is appearing regularly in the local papers with a facsimile of the emblem and a list of local technicians who are affiliated with the Guild.

Officers of the organization include: Bob Collins, president; Orville Smith, vice-president; A. Edward Stevens, treasurer, and Steven J. Petruff, secretary. -30-

Fig. 1.

Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO & TELEVISION NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

TAPE RECORDER

Berlant Associates, 4917 W. Jefferson Blvd., Los Angeles 16, California now has available copies of its new bulletin on the "Concertone" magnetic tape recorder.

The new bulletin illustrates and describes the basic recorder, the unit in a carrying case, and the mechanism in a console cabinet. Complete specifications and prices are given. A schematic diagram and the frequency response characteristics of the recorder are also included.

RIDER CATALOGUE

John F. Rider Publisher, Inc. of 480 Canal Street, New York 13, New York has announced the availability of a new catalogue which is being distributed without charge.

The 8-page catalogue contains a complete up-to-date listing of all the publisher's manuals and textbooks and provides data on the firm's continuous diagram service.

Copies of the catalogue may be secured either from the company's distributors or from the publisher direct.

"BULPLATE" BULLETIN

Ratings and sizes of standard "Bulplate" flat ceramic condensers are given in the new Engineering Bulletin 602 just issued by *Sprague Electric Company* of North Adams, Mass.

The units are made in six different physical sizes in single and multiple capacitance combinations with voltage ratings up to 5000 volts. The bulletin explains how one of these ceramic units may combine all the condensers in one or more electronic circuits into a single, integral assembly, thus permitting a saving of chassis space and a reduction in wiring and soldering time on the production line.

REPLACEMENT GUIDE

The Astatic Corporation of Conneaut, Ohio has just released a new phonograph cartridge directory and replacement guide for service technicians and audio men.

Printed on heavy stock to withstand repeated usage, the directory has a complete listing of cartridge models of all major cartridge manufacturers. Cartridges made by the company's competitors are listed alphabetically and numerically and the recommended *Astatic* replacement for each is indicated.

The new publication includes illustrations of all *Astatic* cartridges and needles, together with complete performance data on each. Another section carries a listing in tabular form of discontinued *Astatic* cartridges and the proper current replacements for them.

Available in quantities, the new directory may be secured from the company by specifying Form No. S-168.

TUBE INVENTORY CONTROL

A new "1951 Tube Movement and Inventory Guide" for the radio service dealer has been announced by the Tube Department of *Radio Corporation of America.*

The 16-page book, in chart form, is designed as a year-round master control covering more than 400 receiving tubes and kinescopes. Through a simplified record-keeping system, the new guide provides the dealer with at-a-glance control of his electron tube stocks and enables him to maintain balanced inventories with a minimum of bookkeeping.

The charts are arranged in double-page spreads to provide tabular space for a full 12-month inventory-order record for every *RCA* receiving tube and kinescope in the dealer's stock.

This new guide is currently available from *RCA* tube and parts distributors.

POCKET TV TUBE GUIDE

Sylvania Electric Products Inc. has announced a new vest pocket TV Tube Selector listing more than 100 TV picture tube types; and indexing them as to round or rectangular shape; metal or glass construction; clear, grey, aluminized or frosted face plates; and the presence or absence of external conductive coating.

This new selector list was prepared especially for the convenience of television technicians and dealers. Copies are available without charge from any authorized *Sylvania* tube distributor.

TUBE HANDBOOK

The Tube Division of the *General Electric Company* has issued a new 107-page pocket-size handbook listing the essential characteristics of every type of receiving tube likely to be found in any home receiver—AM, FM, or television.

Prepared primarily for the service technician, the reference contains ratings and other data essential to fast, efficient troubleshooting. Basing diagrams for each of the 856 different tube types listed are shown on the page with the data.

Included in the new edition of the handbook are the many new receiving tubes recently announced for use in

television applications, a comprehensive coverage of subminiature tubes, and a new section listing the essential physical and electrical characteristics of television picture tubes.

The information presented in the handbook is industry-wide in scope, so the inclusion of the tube in the publication does not necessarily imply the availability of that type from *General Electric*.

The handbook, which is priced at 35 cents a copy, is available only through *General Electric*, and *Ken-Rad* electronic tube distributors.

"TELETRON" CATALOGUE

The Cathode-Ray Tube Division of *Allen B. Du Mont Laboratories, Inc.*, 750 Bloomfield Avenue, Clifton, New Jersey has recently issued a new 12-page catalogue covering its latest types of picture tubes.

Comprehensive information is given on the various "Teletron" types including complete data on the two new electrostatic-focus types 17FP4 and 20GP4 and the 30 inch type 30BP4.

The publication also provides complete ion trap adjustment directions for all of the company's "Teletrons" and basing details for both their electrostatic-focus and magnetic-focus types.

ION BURN BOOKLET

A booklet which tells how to prevent screen damage by ion burns is currently available from *Sheldon Electric Co.*, Irvington 11, New Jersey.

Of interest to television service technicians, dealers, jobbers, and set manufacturers, this pamphlet describes the ion trap, how ion burns occur, and what can be done to prevent the trouble. It also specifies the five basic points to be observed when adjusting the ion trap to prevent screen damage by ions.

Copies of this pamphlet, designated Bulletin T-2, are available without charge from the company.

MASTER INDEX

Supreme Publications, 3727 W. 13th Street, Chicago 23, Illinois is now offering a copy of its "Master Index" which is a complete cross reference to the contents of all ten volumes of the company's "Most-Often-Needed Radio Diagrams" and all five of the television volumes.

Besides serving as an index and guide to technicians who use the company's manuals, the index also contains several pages of explanation on how to use radio diagrams in servicing.

Free copies are available if our readers will make their requests direct to the publisher, enclosing a three-cent stamp to cover postage. Normally the index retails for twenty-five cents.

RECORDING COMPONENTS

Cinema Engineering Company of 1510 West Verdugo Avenue, Burbank, California has recently issued a new 4-page bulletin "Magnetic Recording Components."

How To Prepare for COLOR TELEVISION

By

Milton S. Kiver

Television Consultant, Radio & Television News

CAN YOU AFFORD TO WAIT?

The recent Supreme Court decision, in favor of the C.B.S. Color TV System shows that **color television is here!** Trained technicians capable of servicing the complex black-and-white sets and the even more complex color television circuits will be the ones who will command respectable positions and high salaries as Color TV grows in importance.

The radioman of today who recognizes this growing demand for trained television servicemen . . . who acts by preparing himself now with the proper training and information . . . is the man who is insuring his future. You just cannot afford to waste time!

PROPER TRAINING: A KEY TO SUCCESS

Every practical man knows that to learn TV servicing the right way, you have to do actual TV servicing. You have to know how to locate troubles quickly . . . repair them efficiently. Some men are fortunate enough to be able to attend school. A good many others cannot leave their jobs and so must get whatever they can at home. Fortunately, there is a training program available that teaches you television servicing in a practical, learn-by-doing way.

It's a home study program in which you learn up-to-date practical, professional television servicing in your spare time—without leaving your present job. Included in this course is information on testing, trouble-shooting, repairing and servicing of all types of TV sets plus set conversion, master antenna installation, printed circuits and many field servicing short cuts. In addition, a complete section on Color TV is also included. As developments take place in Color TV, this section will be expanded accordingly, to give you all the latest facts.

PRACTICAL EXPERIENCE IS ESSENTIAL

To give you the experience you need, you build and service a modern large screen television receiver which is furnished as part of the course and which is yours to keep. As an *optional* feature, you can get two weeks of actual field experience going out on service jobs and working on the repair bench for Chicago's largest independent television servicing organization. So practical is this course that after the first few lessons you can start earning money doing actual television servicing!

You can get complete information on this practical television servicing course as well as sample lessons. Just write **Television Communications Institute, 205 W. Wacker Dr., Dept. 1-M, Chicago 6, Ill.**

Included in the listing of components are the company's RE-2 recording head, the PB-10 playback head, the ER-1 erasing head, a tape and film degausser, and a magnetic erasing pencil.

Copies of this bulletin are available from the company on request.

TAPES FOR TV

Technical data on electrical tapes used in the construction of television equipment has been assembled into a new 8-page booklet which is currently available from the *Minnesota Mining and Manufacturing Co.*, 900 Fauquier Street, St. Paul 6, Minn.

The new "Tapes for Television" booklet provides information on production uses for tapes and gives technical data on seven electrical tapes and one filament tape. Ten different designs and one installation-maintenance problem and their solutions are pictured and described.

Included are uses showing deflection yokes, focus coils, flyback coils, electrolytic condensers, and antennas being constructed and serviced.

CRYSTAL CATALOGUE

James Knights Company, Sandwich, Illinois has released a new and comprehensive catalogue covering its full line of modern stabilized crystals for all types of electronic applications.

Designated the Crystal Catalogue #51, the new publication includes dimension drawings and general specifications on the company's crystals and holder types, old replacement types as well as the new. The data is presented in easy-to-use form for quick reference.

BUSINESS FORMS

Oelrich Publications of 4135 N. Lawler Avenue, Chicago 41, Illinois has published a data sheet listing all of the business forms that the company has developed specifically for the radio and television service industry.

One of the newest forms listed is the "Television Service Report," a triplicate form which provides space for entering complete service data on both television sets and antenna installations. Other forms listed include service contracts, television job tickets, radio service records, the company's standard rate book, a radio work sheet, and a television service call book.

COAX DATA

Andrew Corporation of 363 East 75th Street, Chicago 19, Illinois has just issued a comprehensive catalogue entitled "Coaxial Transmission Lines" which is a compilation of many of the company's individual bulletins.

There are ten sections to the catalogue, dealing with semi-flexible coaxial cables, rigid transmission lines, gassing equipment, FM and TV broadcast antennas, communications antennas, microwave antennas, antenna tuning equipment, instruments and components, tower lighting equipment, and a price list.

-30-

300-B Amplifier

(*Continued from page 53*)

frequency stability when only two coupling circuits are employed (the coupling to the two sides of a push-pull stage is considered as one such circuit). This amplifier has four circuits, but one is included within the feedback driver, so that its phase shift is minimized over a wide range, and the other time constants are very long. It would be possible to eliminate the coupling circuit in the feedback loop, going to the off grid of the first tube, by returning the cathodes to a negative point and returning the grids to ground. This was not found necessary with this particular amplifier, but it might be if a different output transformer were used.

High frequency stability is similarly a function of the output transformer, but this time the phase shift in the amplifier is due to the stray capacitance which is present in each stage. Again, for a given transformer, it is desirable to keep the phase response of the amplifier flat to as high a frequency as possible.

At the high frequency end, however, there will be a slight resonance effect in the best transformers. This may not be enough to be detectable in a frequency response curve, but there is a phase variation which will result in ringing if it is not compensated. With any but the finest transformers, this effect will result in excessive ring or even in uncontrolled oscillation.

In this amplifier the trimmer condenser (C_3) in the feedback loop is adjusted to give minimum ring (the slight oscillation at the start of the high frequency square wave). The amount of ring shown in the square wave photographs is permissible, but not desirable.

The square wave photographs will serve as a basis for comparison with other amplifier designs. Significantly greater ring may be considered evidence of a poor output transformer, improper amplifier design, or possibly both.

Despite all this the amplifier sounds good. The total harmonic distortion at 30 watts is approximately .3 percent, and the damping factor is on the order of 30.

There are a number of respects in which this amplifier can be improved; the unit described is, after all, only an experimental one. The principle of the self-balancing feedback driver, however, is one which may be profitably adapted to any design where large amounts of drive voltage are desired at low distortion, without the phase and frequency discrimination inherent in the finest input transformer.

The author wishes to acknowledge the assistance of Kenneth Wisner, who assembled the amplifier, and Jan Syrjala, who prepared the various photographs.

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Signal Substitution

(*Continued from page 63*)

cal signals may be obtained from the integrating network at the output of the last sync amplifier. The horizontal sync signal at the output sync amplifier is also used. It must be understood that these synchronizing signals are of a relatively high value. To adapt them for use as substitute signals at the sync preamplifier where a weaker signal is required, it is necessary to use some attenuation. A simple voltage divider and variable output load may be used, and the load adjusted for the correct signal as measured with the calibrated scope.

At J_3 the vertical saw-tooth used to feed the grid of the vertical output tube may be obtained. To adjust the amplitude of the signal to the correct height, the receiver height and vertical linearity controls may be used.

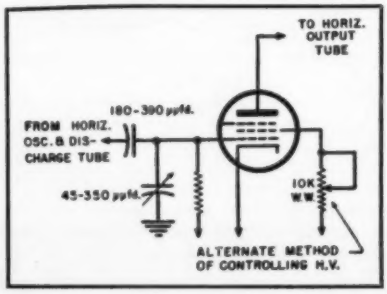
At J_4 the horizontal saw-tooth used to feed the grid of the horizontal output tube may be obtained. To control the amplitude of the signal, the horizontal drive trimmer may be adjusted. However, if the receiver does not have a drive trimmer, one may easily be added. See Fig. 5.

J_5 is the jack used to supply the high voltage to the picture tube. If the test receiver used has a horizontal drive trimmer, the amount of high voltage available at J_5 may be controlled by varying the drive trimmer. Another way of controlling the high voltage is to add a variable resistor, 10,000 ohm wirewound, in the screen circuit of the horizontal output tube. See Fig. 5.

The output from S_1, the horizontal and vertical deflection output, and S_2, the CRT (picture tube) output may be used to test picture tubes and deflection yoke assemblies. If, for example, a case occurs where there is some sweep distortion, the cause of the trouble may be traced quite easily to either the deflection circuits in the receiver under test, or the deflection yoke.

The input to the audio amplifier of the receiver is wired to J_6. At this point the signal obtained may be used to check audio amplifiers and audio systems in other receivers. By removing the FM detector tube an audio signal may be fed into J_6, and the audio amplifier in the bench receiver may be

Fig. 5. Circuit diagram shows method for adding horizontal drive trimmer.



used to check phonograph pickups or sound i.f. systems of other receivers.

To facilitate testing and alignment of front ends, a convenient filament and "B+" voltage supply may be obtained from the bench receiver. This is shown in Fig. 1 as J_7.

To make a final air check of front ends, the bench receiver tuner may be removed and the leads to the tuner made readily accessible so that the tuner under test may be easily substituted.

A block diagram of a typical television receiver is shown in Fig. 4. The sources of the substitute signals are shown on the diagram, including the various waveforms which can be found at these sources. —30—

RCA Set Conversion

(*Continued from page 44*)

to accommodate the new 14" picture tube. This panel was marked with the same template previously used. The four angles and screws which held the 10BP4 in place were removed and the section marked off was sawed out. Four holes, two on the bottom and one on each side near the top, were drilled about ¼" in from the sawed edge. The four screws were inserted and the four angles mounted. Only the two bottom screws were tightened to hold the picture tube in place.

The chassis, complete with picture tube, was then placed in the cabinet and the front panel was mounted on the cabinet. The picture tube was centered by adjusting and tightening the four mounting angles. It was necessary to remove and replace the front panel a few times in order to center the picture tube properly. Finally, all screws and knobs were replaced and all electrical connections made, which completed the conversion.

As mentioned in connection with the other conversions, while these circuit modifications have been carefully tested, the *General Electric Company* can assume no responsibility for the application of these suggestions to the conversion of any particular receiver. If such conversions are performed it is possible that the manufacturer's warranty on the set may be invalidated. —30—

Mac's Service Shop

(*Continued from page 59*)

and tell me why that did it," the youth demanded of his employer.

"Because when You-Know-Who put the new battery in he did not do a good job," Mac replied softly. "If he had, he would have carefully cleaned off the banana plugs that slip into the battery terminals, spread the springs a little if necessary, and then coated them with vaseline. Had he done that, we wouldn't have this poor connection that is causing the trouble now. Clean up the terminals and put a 'No Charge' ticket on the set."

Barney's face was a little red as he went about this, but he still managed to pipe up: "I still can't understand why a poor battery connection should cause hum. If I had the a.c. plugged in, I'd think the pulsating output of the charger was doing it, but when the line cord is not even plugged in—"

"I'm not sure that I know either," Mac frankly admitted; "but I've got a theory. A storage battery ordinarily has excellent voltage regulation, but a poor terminal contact destroys this ability to deliver a constant voltage under heavy current demands. The closing of the contact points of the vibrator causes regular pulses of current to be drawn from the battery. These pulses of current, in turn, cause dips in the voltage delivered to the filaments of the tubes; and since these fine filaments have very little thermal lag, their emission goes up and down at the vibrator frequency and causes hum."

"An ingenious theory, even if it may be all wet!" Barney applauded. "And speaking of ingenuity, Al, the parts salesman, was telling me a good one when he was here during your vacation. He says one of his customers up in the northern part of the state runs the twin-lead from his tower-mounted TV receiving antenna right into a broadband booster on his showroom floor. The output of this booster is fed into a 'rabbit ears' indoor antenna. When this set-up is in operation, any set within thirty or forty feet of the rabbit ears can pick up a good picture by virtue of the signal re-radiated from the rabbit ears to its own built-in antenna. Sets back in the service department can use this re-radiated signal, too. While the picture is not quite as good as it is when the output of the booster is run directly to the terminals of a single receiver, the system works surprisingly well and saves a whale of a lot of connecting and disconnecting."

"Hm-m-m-m," Mac commented; "that is one for the books! I'd imagine you'd have to keep the receiving antenna and the rabbit ears pretty well separated and the booster gain not too high to avoid feedback trouble; but it certainly has interesting possibilities. Replacing the rabbit ears with a directional type of antenna would give you a chance to check its radiation charac-

teristics, which is simply its receiving characteristics in reverse. We've got to look into that."

"How was that vacation? Did you get away from service entirely?"

"We-l-l-l, not quite," Mac confessed. "We went to visit my cousin who lives near Orlando, right in the middle of that beautiful lake and orange grove country. My cousin really knocked himself out seeing that we had a good time. Every day we were either yanking the bass, shell-crackers, and bream out of Lake Beau Claire or horsing in the saltwater trout over in Mosquito Lagoon near the Indian River. After we had eaten him out of house and home, worn out his out-board, and chewed about a half-inch off the tread of his tires riding around over those rough-finished Florida black-top roads, we could hardly ignore the fact that none of his radios were working properly. I didn't even try to explain that a technician is pretty severely handicapped trying to work without his instruments. That is something you can't make a layman understand anyway.

"We first tackled the receiver in his station wagon that simply had no punch. Touching the antenna while standing on the ground had practically no effect on the volume; so I diagnosed either an open or shorted antenna connection. My fingers itched for my good old ohmmeter, but since I did not have it, I disconnected the antenna lead from the set and tried touching the antenna connection itself, but this had little result, either. The cover was removed from the set, and it was easy to spot that the lead running from the antenna was shorting to the tuning condenser frame. Clearing this up and touching up the i.f. and r.f. trimmers strictly 'by ear' made the set perform like new.

"The next item was purely a mechanical problem: a broken fabric dial belt. Had I been here, all I should have needed to do was to glance in my *JFD* belt guide and picked out the exact replacement belt needed; but we had no time to start looking for a belt on this last night before starting home. A length of his heavy surf-casting line was cut off and passed around the pulleys in two complete loops, pulled tight, and tied with a hard knot. Surprisingly enough, it worked to perfection, with the knot passing smoothly over the driver, driven, and idler pulleys.

"The last set really threw me, though. It was a case of an intermittent growling noise that broke in on reception at irregular intervals. It sounded somewhat like the noise produced by a poor connection being shaken by vibrations from the speaker. I removed the set from the cabinet and tapped every tube, condenser, resistor, and solder connection in it without once triggering the noise. Then I thought I had spotted it: the rubber insulation had broken away from an i.f. grid lead and allowed the bare wire to touch the edge of the tube shield. I

carefully taped this with *Scotch Tape*, resoldered a couple of suspicious-looking solder joints for good measure, and replaced the set in the cabinet. It played beautifully for about a half hour, and then the same old noise blatted forth for a few seconds, after which the radio started performing perfectly OK again. I was all for yanking it out again, but my cousin wouldn't let me."

"I'm glad!" Barney rejoiced. "You can't imagine how much good it does me to know that there is one set you didn't fix!"

"I hate to spoil your pleaseure," Mac said with a slow grin, "but that darned set has been on my mind so much since I came home that I have decided to have my cousin ship it up here and let me work on it where I have something to work with. I've got to know what's ailing it."

"I might have known," Barney said with a sigh of resignation. "I suppose the point of all this is to show what a good job of servicing can be done without the usual equipment."

"You couldn't be 'wronger,'" Mac quickly retorted. "The single impression I got out of the whole experience was a strong reminder that good equipment is absolutely essential for doing fast, efficient, and dependable service. Not a one of those service jobs was really satisfactory. Aligning them with a broadcast signal is a mighty poor substitute for a signal-generator job of alignment, and I'm confident that fishing-line dial belt will start slipping before long.

"What's more, at least a dozen times I found my hand groping automatically for the familiar handles of my sharp-nose pliers and my diagonal cutters. Also, for your information, a flattened tenpenny nail is a darned poor substitute for a knob-set-screw screwdriver! The worst, though, was that two-pound, torch-heated soldering iron. Working with it in a radio was just like trying to use a fence-picket for a toothpick.

"A taste of that hard-way servicing really made me appreciate the instruments and tools we have here," Mac went on as his eyes swept affectionately down the length of the service bench; "and I made up my mind to take even better care of this equipment in the future than I have in the past. What's more, while I was at it and just to save you the trouble, I made a resolution for you to do the same thing, Buster!"

"Gee, thanks, Boss!" Barney said with an impish grin.

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MICROPHONE FIXTURES FROM ELECTRICAL SWIVELS

By ARTHUR TRAUFFER

THE low-cost ball and socket swivels made for electric lamp fixtures make mighty handy microphone fittings.

Fig. 2A is an exploded view of the swivel. The cap and shell are joined by means of 5/8"-27 threads which are the standard threads for mikes!

Fig. 2B shows how the swivel shell can be used as a reducing adapter to fit a mike to a folding and telescoping photolamp stand. Most of these lamp stands have 3/8" diameter draw tubes, so thread the draw tube with a 1/8"-27 NPT die, screw the swivel shell into the tube, and you have a portable mike stand.

In Figs. 1 and 2C, a complete swivel is added between the swivel shell and the draw tube to provide a swivel for the mike. The mike can then be lowered or tilted to avoid obscuring the user's face.

Fig. 2D shows how a spare swivel cap can be used to seal an unused mike input. A fiber or metal disc inside the cap closes the hole. The metal disc can be soldered to the cap. —30—

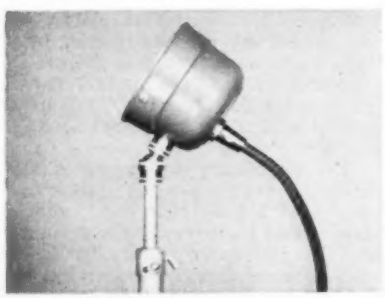
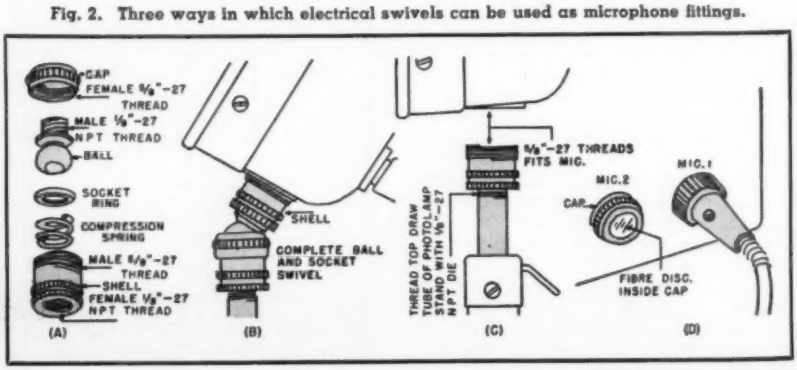


Fig. 1. Swivel used with mike and stand.

Fig. 2. Three ways in which electrical swivels can be used as microphone fittings.



International Short-Wave

(*Continued from page* 109)

Guatemala—TGNA was recently heard on (announced) 5.995 with fair level but with bad CWQRM at times; was in dual with 9.668 when noted 2205. (Bellington, N.Y.) TGWA recently moved lower in the 31-m. band. (Bellington, N.Y., others) Measured 9.7588V at 1905; previous measurements included 9.7636 and 9.7643. (Oskay, N.J.) Sutton, Ohio, reports a *new* Guatemala outlet on 15.305, noted 0800-0830.

Haiti—4VEH, Cape-Haitien, verified in 25 days; says uses 9.550 which is switched at times to 9.557; listed *English* for Sun. 1915. (Young, Ky.) 4VRW, 9.84, Port-au-Prince, noted 2045-2120. (Pozo, Cuba)

Holland—Hilversum has *English* for North America 2130-2210, 11.73, 9.59; for South Africa, Great Britain, Ireland, Continental Europe, 1500-1540, 11.73, 9.59, 6.025; for South Asia, 1100-1130, 15.22, 11.73; for Australia, New Zealand, Pacific Area, 0530-0610, 21.48, 17.775, 15.22, 6.025. *"The Happy Station Program"* of Eddie Startz is now on *Sundays only*—0530-0700, 21.48, 17.775, 15.22, 6.025 to the East, Pacific Area, Europe; 1100-1230, 15.22, 11.73, 6.025, to Near and Middle East, Europe; 1630-1800, 11.73, 9.59, 6.025, to South and Central America, and 2130-2300, 11.73, 9.59, to North America.

Honduras—Cadena Radial Hondurena operates on 850 kc., m.w., 300 watts (announces Radio Monserrat, HROW); 6.02, 500 watts (announces Radio Reloj Musical); 6.675, 2 kw. (announces Radio Monserrat, HROW, La Emisora de los Hondurenos); complete schedule for *all* channels is 0750-2300; all-Spanish; QRA is HROW, Radio Monserrat, Parque Finlay, Tegucigalpa, Honduras. (Serrano, Brazil) HRD2, 6.235, "La Voz de Atlantida," noted 2121-2145 in all-Spanish program. (Patterson, Ga.) HRXW, 8.990, *Radio Comoyaguilla,* noted to 2300 sign-off; *Radio Progresso*, San Pedro Sula, 6.187, signs off 2300 to 2310; a station noted lately on 6.177 evenings (*EST*) is believed *Radio Tela*, at Tela, a small town up the coast from La Ceiba; signs off 2200. (Stark, Texas)

India—VUD, 17.740, Delhi, noted 0600-0945 at fair strength, replacing 17.840. (Legge, N.Y., via NNRC) Heard on this channel 0830-0945, announcing 15.29 in parallel; the 1400-1500 broadcast in *English* still noted on 9.720, 7.155. (Pearce, England) Still heard 1930 with news on 15.29 (announces 11.85 in parallel). (Morales, La., others) The 15.16 channel is heard well in West Virginia around 2100. (Dalton) Is scheduled on that channel daily 2030-2200 with native all-musical session. (Bellington, N.Y.) The 7.155 outlet is good early mornings (*EST*) in Calif.; noted opening 1045 with news on 11.83, 1529. (Dilg, Calif.)

Indo-China (Vietnam)—Ferguson, N.C., recently measured *Radio France-*

Asie, Saigon, in 31-m. band as 9.799; noted mornings (*EST*). At the time this was written, Balbi, Calif., noted RFA from 0520 sign-on using 9.799 and 7.225; sign-off is around 1030. Balbi says the station on 7.265 sounds very much like "Vietnam," noted weak to fair after 0200, but is not readable at 0915 when "Vietnam" has news on 9.620. Later report from Balbi says has heard "La Voix de Vietnam" on a *new* channel of 6.107 with French 0800-0830 and with the *English* news 0915, parallel 9.62. And Rosenauer, Calif., flashes he has heard "La Voix de Vietnam" on 7.105 at 0830-0930 sign-off, carrying the news 0915 in parallel with 9.620.

RFA, 11.78, Saigon, noted signing off 1025 after "La Marseillaise." (Russell, Calif., others) Has news 0900. Heard on 11.83 by Rosenauer, Calif., 0400-0500 with *English* session. More recently, Balbi, Calif., notes it on either 11.84 or 11.83 (seems to alternate or at least vary) with news both 0400, 0500, and signing off on that frequency 0515.

Iran—Radio Teheran, 15.100, is good level in 1500 news. (Boice, Conn.) Still signs off 1530 after Russian period (this usually is jammed!).

Verification was received recently for 3.930, Teheran; listed outlet on 3.960 as EQO but in QSL gave the 3.930 outlet as EPP. (Peddle, Newfoundland)

Iraq—Baghdad, 7.092, now closes 1415 after a newscast in Arabic; however, on Sundays the Arabic runs to 1428, followed by Western recordings to 1510, according to British sources. Dilg, Calif., hears a station on this channel 0930 that is most likely *Radio Baghdad;* fairly good level.

Ireland—Radio Eirrean, 17.84, not reported to me lately. Channel was checked recently by Cox, Dela., and myself, at 1230 and 1330 (should have news at one of those times) but *Radio Eirrean* could not be located. The station recently sent this message to Russell, Calif.—"The 100 kw. transmitter was completed about three years ago, but the new government coming into power at that time decided that in view of the demands of the other public services, the expenditures which would be necessary on the short-wave transmissions would not be justified, so the projected programs did not materialize." (Results of the recent election in Eire might change the situation?—KRB)

Israel—Tel Aviv, 17.665, is a radiotelephone station—not a broadcast outlet. (Peddle, Newfoundland)

Although *Kol-Israel* was scheduled to inaugurate its *new* 50 kw. transmitters (s.w. and m.w.) on May 14—Israeli Independence Day—at the time this was compiled, it appeared that the new high-powered station was not yet on the air. (Pearce, England; Bellington, N.Y., others) Channels to try include 9.010A, 9.500, 9.640, 11.935, 15.415, 17.880, 21.465, and possibly 6.830.—KRB

Noted on 9.010A with Yiddish 1100 and with the usual *"Voice of Zion"*

(*English*) session 1615-1700 sign-off. (Pearce, England) The 1615-1700 *English* period noted also in West Virginia, but at weak level lately.—KRB

Italy—Of the several frequencies used by Rome evenings (*EST*) to North America, 15.420 seems the best (usually with a "local powerhouse" signal). Has news 2145-2200 sign-off.

Jamaica—Radio Jamaica, Kingston, has moved from 3.36 to (announced) 4.82; has good signal with only slight QRM, is much better than when on 3.36; does *not* have BBC news relay 2300 any longer but closes with "God Save the King" at that hour. (Bellington, N.Y.) Noted by Oskay, N.J., 1945, measured 4.820. Widely reported.

Japan—AFRS, 9.605, Tokyo, good to excellent in Oregon; becomes audible around 2000. (Slattery) AFRS, Tokyo, now stays on JKI4, 11.80, JKL2, 9.605, to 0500, when is replaced by JK13, 6.175, JKL, 4.860; Tokyo's Home Service, JBD3, 15.225, JKI2, 9.655, now is on to 0415, when JKI, 4.91, JBD, 9.505, JBD2, 9.56, take over; JKM2, 9.695, signs off 0400, replaced by JKM, 4.94; Tokyo has a *new* frequency of 6.135, heard only 0400-0500 in parallel with JKI, 4.91, and JKJ; the JKJ and JKH stations noted from around 0100 onwards; also 6.19 is on as late as 0730, while JO8G, 6.005, signs off around 0600; the 6.015 channel is now heard in the Home Service with powerful level 0800-1000. (Balbi, Calif.) JKH, 7.257, and JKJ, 7.285, noted with good signals around 0600 but carrying separate programs (all-Japanese). (Dary, Kans.)

Kenya Colony—Leslie Knight, FBS, Middle East, says now that the FBS outlets at Malta are being moved to Fayid, Suez Canal Zone, the only FBS outlet currently in use is Mackinnon Road, 6.115, 150 watts, scheduled weekdays 2200-0000, 0430-0630, 0900-1400, Sun. 0000-0600, 0800-1400, Sat. 2200 (Fri. *EST*) to 0000 (Sat. *EST*), 0430-0630, 0900-1500. (Hankins, Pa.)

VQG1, 4.855, Nairobi, noted 1445-1501 sign-off. (*GDX-aren,* Sweden) Noted by Pearce, England, closing 1400 *except* Wed., Sat., when runs to 1500; notes BBC news relay 1300, then local news, weather forecast, South Africa news (1315), then music and verse for relaxation at 1330.

Korea—At the time this was compiled, only Korean outlet reported to the *ISW DEPARTMENT* was that heard by Dilg, Calif., on approximately 4.775, definitely a "South" Korean outlet—probably at Pusan—noted best *before* 0900.

Lebanon—Ici Radio Liban, 8.036, Beirut, noted in French 1445, then going into Arabic 1515. (Pearce, England) Noted in Arabic also 1215, with bad CWQRM. (McWalter, Scotland)

Madagascar — Radio Tananarive, 9.515, noted with weak signal 2230 sign-on; the 9.693 channel heard 2330 with Malgache music, through heavy QRM from LRA, Buenos Aires, 9.690. (Cox, Dela.) Sun. sign-on of the 9.515 channel is still 0000. (Machwart, Mich.)

Malaya — BREBS, Singapore, has been coming through with good level mornings around 0600 on its 9.69 channel. (Oskay, N.J.) Is using 7.120 now but *Radio Malaya*, also Singapore, is still on 7.200. (Rosenauer, Calif., others) Is now using new high-powered (probably 100 kw.) BBC transmitter; Frequencies employed at times during the daily 0415-1130 schedule now include 21.72, 17.755, 15.30, 11.88, 7.120, 6.175. (Boice, Conn., others) *Radio Malaya*, 6.025, Kuala Lumpur, noted 0900 with news. (Russell, Calif.) Also has news 0630. (Rosenauer, Calif.)

Monaco—Radio Monte Carlo, 9.785, 6.035, now signs on 0100. (Pearce, England; Machwart, Mich.)

Mozambique—Lourenco Marques noted in Portuguese 1233 on approximately 9.855. (Pearce, England) *English* session still noted from 2300 signon on 4.920 (weak to fair) and 11.767 (stronger). (Dary, Kans.)

New Zealand—New schedules of *Radio New Zealand*, Wellington, are 1300-1545, ZL2, 9.54; 1600-0145, ZL10, 15.22; 0200 to closedown, ZL2, 9.54, all these to Australia; 1300-1545, ZL8, 9.62; 1600-0145, ZL4, 15.28, and 0200 to closedown, ZL8, 9.62, all these to Pacific Islands; closedown is 0545 weekdays; 0620 Sat.; 0500 Sun.

Nicaragua—Bellington, N.Y., reports a Nicaraguan outlet on 11.78 some evenings (*EST*) around 1800 and later with popular American songs; fair level; may be YNOW on a *new* channel?

Pakistan—A "General Overseas Service," news at slow speed, is reported daily 1210-1230 from *Radio Pakistan*, Karachi, on 7.010 and 11.650. (Radio Sweden) Pearce, England, confirms schedule—but says hears it on approximately 11.915 (announced 11.914, 6.240). Noted on 17.770 with news 0110-0120 (Home Service) followed by news in Bengali, and again with news 0210-0220 (Home Service) followed by news in Urdu. (Pearce, England) Morales, La., reports *Radio Pakistan* on approximately 15.600 with news 0700. Sanderson, Australia, lists the 0700 news heard on 9.755 and 11.885, then a program in Urdu. Overseas sources says Lahore is on 4.810, and has news relay from Karachi 1015-1030.

Peru—The Peruvian outlet heard on 9.49 closing down 2225 is *Radio Tacna* with call OAX6H, listed 9.500. (Serrano, Brazil) Lima, 5.980, opens 0615; closes 0100. (Morales, La.)

Philippines—The Far Eastern Broadcasting Co., 9.733A, Manila, has news 0500. (Stark, Texas; Stein, Calif.) Is using DZAS, 6.80 mc.; DZB2, 3.320; DZH6, 6.030; DZH7, 9.730; DZH8, 15.300; soon should have an additional channel (DZH9, in the 25-m. band—probably around 11.885); schedule is weekdays 1700-1815, Japanese, Russian, Indonesian, Mandarin on 15.300, 9.730; 1830-2000 *English* on all frequencies; 2030-2330 various oriental languages on 15.300, 9.730, 6.030; 0700-0835, *English* on all frequencies; 0900-1200 various Middle and Far East lan-

guages; Sundays 1700-1745 Japanese, Chinese on 15.300, 9.730; 1800-2300 *English* on all frequencies; 0000-0015 Japanese on 15.300, 9.730; 0030-0600 *English* on all frequencies; 0630-0715, Chinese, Mandarin on 15.300, 9.730, 6.030; 0730-1030 English on all frequencies; 1100-1200 Arabic, Yiddish, Russian. (*WRH Bulletin*). Noted in Calif. on 15.300 with news 0000-0010, then religious program. (Russell) DZ13 is on about 6.098. (Balbi, Calif.) The Philippines Broadcasting Corporation, 9.500, Manila, noted 0500 with recordings. (Win, Calif.)

Poland—Radio Warsaw now has *English* for North America 1745 on 11.815, repeated 2315 on 9.57; 1930 on 11.815, repeated 0030 on 9.57; usually has terrific QRM on 9.57 from U.S. outlet, same channel. (Bellington, N.Y.) Noted on 11.815 at 1930-2000 in *English*, then into Polish; fine level and no QRM. (Chatfield, N.Y.; Hoogerheide, Wisc.) Warsaw announces *English* for Europe 1230-1300, 1350-1420, 9.525; 1315-1345, 1615-1645, 9.570. (Pearce, England)

Portuguese Guinea—Bissau is still heard most days from 1630 with musical programs on 5.839. (McWalter, Scotland)

Portuguese India—No sign of the "purported" *Radio Goa* on 9.260. (Pearce, England, others) Probably still is on 9.610.—KRB

Roumania—Bucharest, 9.252, lately has had *English* 1530 rather than (former) 1400; French noted 1500; announced as parallel in 25- and 48-m. bands (probably 11.900, 5.990). (Pearce, England)

South Africa—Cape Town, now on 5.890 (formerly 5.880A), is again coming through in Delaware; noted 0000 with news to 0010, then music; occasionally blocked by powerful carrier. Johannesburg III, 4.895, noted parallel Cape Town 0000 for news, weather data; identified 0015 with chimes; faded 0030. (Cox)

Current SABC schedules are—Johannesburg on 4.80 at 2345-0230 (Sun. 0055-0230) 7.290, Mon.-Fri., 0315-0715, 0900-1130, Sat. and Sun. 0315-1130; 3.29, Mon.-Fri., 1140-1605, Sat. 1140-1645, Sun. (1200-1605). Johannesburg (Commercial Programs) on 4.945, Mon.-Sat. 2300-0230; 7.295, Mon.-Sat. 0130-1100, Sun. 0100-1115; 4.945, Mon.-Sat. 1100-1400 (Sun. 1115-1400); 3.35, Mon.-Sat. 1400-1700 (Sun.-1500-1600). Cape Town (Afrikaans) on 5.89, Mon.-Fri. 2345-0230, 1145-1605; Sat. 2345-0230, 1145-1645; Sun. 0055-0230, 1145-1605; on 9.615, Mon.-Fri. 0315-0715, 0900-1130, Sat. 0315-1130, Sun. 0315-1130. Pietermaritzburg (Afrikaans) on 4.878, Mon.-Fri. 2345-0230; 0315-0715, 0900-1605; Sat. 2345-0230, 0315-1645; Sun. 0055-0230, 0315-1605. Experimental Transmitter, African Service, Johannesburg Program, on 15.23, 0330-0715, 0900-1045; 9.87, 1100-1505 (Sat. to 1645); on Sun., Mon., Wed., Fri. has Afrikaans; on Tues., Thur., Sat. has *English*. Experimental transmitter to South West Africa (Johannesburg Program), has *English* program on

9.68 same times as Johannesburg's *English* sessions. (Hannaford, Sou. Afr.)

Spain—Lately, Madrid has been on about 9.355 rather than listed 9.369. (Bellington, N.Y., others) Measured 9.356V at 1850; two days later at 1605 was measured 9.3517; measurement some time ago was 9.368. (Oskay, N.J.) Alicante is moving around again; noted recently 1600 near 8.24, strong signal but poor modulation; noted later 1530 back near 8.140. (Pearce, England) World Radio Society, Sweden, lists FET1, Radio Falange de Valladolid, on 7.006, heard 1530-1600; and EAJ9, Radio Nacional de Espana en Malaga, 7.022, heard 1600.

Surinam—Paramaribo, 15.407, noted signing off 2058 with Dutch National Anthem; good level but with slight QRM from Rome's 15.420 outlet; announces "Radio Surinam." (Dary, Kans.) Has *English* religious programs Sundays 1800-1830. (Sutton, Ohio)

Switzerland—Berne noted on 15.120 with news 1200. (Cox, Dela.) International Red Cross, Geneva, on 7.210, heard 1655 with call in *English*, French, Spanish, German, asking for reports on strength, quality, to International Committee of Red Cross, Geneva, Switzerland; said tests in *English* 0130, 0700, 1530, 1700. (Pearce, England)

Syria—Damascus noted near 9.585 with news 1630; announced as operating in 25-, 41-, and 50-m. bands, and announced news for 0600, 1630; another day heard with news 1630 near 11.920 and near 9.585. (Pearce, England) *Radio Sweden* reports Damascus testing on 6.165, 9.55, 11.915 at 2330-0200, 0630-0830, 1110-1630, 1630-1730.

Tahiti—*Radio Tahiti*, 6.135, Papeete, now seems scheduled 2300-0130 although at times may end transmission 0050. Appears to have *English* program Wednesdays 0000-0015. (Slattery, Ore.) Current schedule confirmed; signs off now 0130 with "La Marseillaise." (Bellington, N.Y.) Swedish sources report *Radio Tahiti* with its new 24 kw. transmitter heard on 9.053 ending *English* broadcast 0030. *Not* confirmed by *ISW DEPARTMENT* monitors in USA who have checked regularly for this one.—KRB

Taiwan (*Formosa*)—BED7, 7.133, Taipeh, is probably best of the Nationalist Chinese outlets currently, very good signal with news 0630; BED6, 11.735, Taipeh, fair level, parallels 7.133, holds up to about 1000 on West Coast; BEC22, 7.010, Taipeh, heard fairly well around 0900; BED32, 8.995, Taipeh, fair signal, leaves air around 0900. (Dilg, Calif.) The Home Service of "Voice of Free China" now signs on 0300 (one hour earlier) on 8.99, 7.000, 6.095 (BED29); not heard on 6.40 any longer. (Balbi, Calif.) Sanderson, Australia, lists BED44, 7.000, at 0630 with Chinese-*English* lesson; BCAF, 8.996, at 0630 with "Bringing Christ to the Nations" (*English*) but didn't state what day (most likely Sun. or Wed.—KRB). Cushen, N.Z., reports a new Taiwan outlet heard on 7.360 around 0700.

Tangier—Pan-American Radio, 7.400, noted 1500 when clock strikes 9 p.m. (Cushen, N.Z.)

Thailand—Bangkok noted on 6.24 with native program around 0800; weak, badly QRM'd. (Balbi, Calif.) Heard on 11.91 at 0550 with news and music. (Sanderson, Australia)

Turkey—TAT, 9.515, still noted in experimental *English* period to North America daily 1815-1900; asks for reports to English Section, Radio Ankara, Ankara, Turkey. (Simonian, Mass.; Kinge, N.Y., others) TAV, 17.825, Ankara, noted 0630-0715 in *English* to Australia, New Zealand; fair strength. TAU, 15.165 (announced 15.160 but measured 15.165 by Oskay, N.J.), is heard well 1315-1600 with programs for Europe, having replaced TAS, 7.285, for the summer. (Legge, N.Y., via NNRC, others) Pearce, England, notes TAU, 15.165, to Europe and British Isles in *English* now 1500-1545, parallel TAP, 9.465; Mailbag session Sundays is still 1530 on these channels, according to Bellington, N.Y., others.

National anthem of Turkey, which concludes most short-wave broadcasts from Ankara, is "The Independence March." (Bellington, N.Y.)

Uruguay—CXA19, 11.835, Montevideo, *Radio El Espectador,* 5 kw., noted 1950-2200 sign-off with varied music; best 2000-2130. (Rastorfer, N.Y.)

USI—YDE, 11.77, Djakarta, noted with news 1025; announces "This is the Voice of Indonesia, broadcasting from Djakarta"; signs off 1030 with chimes, carrier returns 1035, chimes 1059 and then re-opens with announcements in foreign language. (Russell, Calif.) *Radio Indonesia,* Menado, Celebes, 9.830, noted 0830-0945 sign-off; popular Western music with announcements in Indonesian; identification is "Disini Menado, Radio Indonesia Serikat"; good level in Calif. (Rosenauer) YDQ2, 9.552, Makassar, Celebes, noted around 0900 with native announcements and music; woman announces at 0930, then program continues in native. (Russell, Calif.)

USSR—Radio Moscow noted in *English* 1230 (probably for Europe) on 15.36, 11.63, 9.83. (Chatfield, N.Y.) Noted on 15.36 in *English* 1300-1400 for Europe. (Leary, Ind.) Heard there with *English* in progress 1135. (Bellington, N.Y.) *Radio Tashkent,* 6.825, lists *English* daily 1000-1030, 1115-1130. (Radio Sweden)

A Soviet outlet is noted on 11.755 as early as 1915 to 2230 sign-off; last period is Spanish. (Leary, Ind.) Also noted evenings by Weldon Wilson, URDXC, who also reports Moscow heard on 15.425 at 1700.

Petropavlovsk, 6.07, does *not* have Chinese transmission on Sundays 0530-0615 but carries Home Service in parallel with RV15, 5.94, at that time; 7.40 and 5.265 also are off Sundays in Chinese transmission. (Balbi, Calif.) Khabarovsk, 5.940, noted with good signal lately 0530-0615; features musical request concerts for Germany; a stronger outlet of Khabarovsk is 6.075 in Russian to 0530 when there is a

three-minute break, a woman announces in Russian that the program is beamed to the Far East; at 0530, "The Democratic Youth Song" is played after which program continues in Chinese—with the Russian language section being carried on 5.940. (Grischott, Calif.)

Vatican—HVJ noted with news 1000-1015 on 15.120, 11.740, 9.646; announces *English* for 1315 on 25.55, 31.10, 50.26, and 196 meters (try 11.74, 9.646, 5.969). (Pearce, England)

Venezuela—YVLK, Caracas, is harmonic of 4.970; heard evenings. Do not confuse. (Legge, N.Y., via NNRC)

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Press Time Flashes

While *Radio Sofia,* Bulgaria, announces *English* for Europe at 1500, 1600 on 6.070, it has been heard usually on 15.33. (Bellington, N.Y.) If not found on 15.33, the 6.070 channel should be checked.—KRB. Pearce, England, flashes he has noted Sofia on 6.070 with news 1500-1515 and announcing further *English* for 1600-1630 (when is severely QRM'd by the BBC's European Service on that channel).

ZAN, 11.670, location unknown, was heard testing recently in *English* with SDQ3, Sweden, 1745-1900; said would test again the next "night." Is possibly Albania, judging from call. (Focht via NNRC)

Serrano, Brazil, flashes this "unconfirmed" tip—a *new* station is operating in Macau, Portuguese China; is *Radio Vila Verde,* testing on 9.500 with transmissions in *English,* Portuguese, and Chinese; schedule unknown. *Can anyone confirm?*—KRB

According to *Short Wave News,* London, *"Radio Guinea,"* Conakry, operates on 10.230 with 1 kw., daily *except* Sun. 0715-0730. *Can anyone confirm?* —KRB (Fr. Guinea is a part of Fr. West Africa, with an area of 96,885 square miles and a 1931 population of 2,065,527.—KRB)

Radio Sweden recently issued this information on "clandestine" outlets—*Radio Stanica Yugoslovenskich Revolutionarnich Emigranta* is audible daily 0030-0050, 0900-0945, probably also in the "evenings" (*GMT*) on 6.888, 7.444. *Radio Euzkadi,* La Voz de la Resistencia Basca, is heard on 6.560 at 1600-1630. The Russian Underground Station (believed somewhere in Western Germany—KRB) was heard recently 1535 on 7.730 and another day 1500 on 7.550; usually is jammed.

A flash from Pearce, England, at press time, says he now hears Damascus, Syria, *only* on 11.920A with news 1630-1640; music 1700-1730, then news in French; announces "Service to Europe on 26 meters."

Hannaford, South Africa, flashes that he has heard *"Radio Chad,"* 15.596, Fr. Equatorial Africa, 0030-0130 daily; has prayers and music; male announcer only, calls "Houna Radio Chad" and uses reed instrument at beginning and end of session. (Chad is a colony of Fr. Equatorial Africa—French Congo —with 461,202 square miles of area,

and a 1931 population of 1,432,555.—KRB)

Dilg, Calif., flashes that *Radio Peking* recently announced a frequency of 15.170 in addition to other channels (10.260, 11.685, 15.060, and probably 6.100—KRB).

Hollandia, Dutch New Guinea, noted on 7.150A at 0527 playing "Goodnight, Sweetheart" song after which announcer said "Gut Nacht"; but continued with American recordings, so may have been a relay; 0615 had Dutch talk and signed off 0630 with Dutch National Anthem; don't confuse with Indian on 7.155. (Dilg, Calif.)

Summer schedule of *Radio Moscow* to North America in *English* is—0800-0830, 17.83, 15.44, 15.20, 15.12, 11.96, 11.91, 11.63, 9.83; 1820-1930, 2030-2300, 15.23, 15,18, 15.11, 11.91, 11.82, 11.81, 9.83, 9.67, 9.55; 1930-2030, 15.23, 15.18, 15.11, 11.82, 9.67; and to Pacific Coast, 2300-0100, 17.81, 15.23, 15.18, 15.11, 11.82. Programs in *English* to the Far East and Europe are scheduled 0300-0330, 17.81, 15.10, 11.78; 0400-0500, 17.81, 15.44, 15.36, 15.20, 15.10, 11.63, 11.78, 9.68; 0530-0600, 17.84, 17.81, 15.36, 15.41, 15.20, 11.78, 11.63, 9.68.

Tangiers, 6.247, operates Mon.-Fri. 1200-1300 with various language-editions of "Bringing Christ to the Nations"; uses 17 languages; *English* edition is Wednesday 1200; for world coverage, 36 languages are used over some 1200 stations located in 51 countries for "Bringing Christ to the Nations." (ISWL, London)

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Acknowledgement

Thanks for the many fine reports. Keep them coming to Kenneth R. Boord, 948 Stewartstown Road, Morgantown, West Virginia, USA. . KRB

Standard Coil Products Co., Inc., of Chicago recently demonstrated how a simple transfer of coils permits any television receiver equipped with a Standard Tuner to be used for u.h.f. reception. Since over 4,500,000 contemporary receivers, or approximately 40 per-cent of the total in use, are so equipped, this means that a simple and economical adjustment of the tuner will be all that is required to obtain u.h.f. reception. The demonstration was conducted at Bridgeport, Conn., using several standard receivers and signals transmitted from RCA's experimental u.h.f. station, KC2XAK. The sets were adapted in less than five minutes by an interchange of channel coils within the tuner. According to the company, the process even with the combined cost of time and labor plus the u.h.f. coils themselves will run lower than the price of a separate converter.

RADIO-TV Service Industry News

AS REPORTED BY THE TELEVISION TECHNICIANS LECTURE BUREAU

Service Implications of Color TV

WE NOW have an authorized system for color television. It is called the *field sequential system* and was perfected in the research and development laboratories of the *Columbia Broadcasting System*. It is a highly controversial system because it requires an entirely different set of standards than the present system of monochrome TV and also because, in the present state of the art, the color is reproduced by means of either a motor-driven drum or disc. However, the field sequential system *is not* irrevocably tied to this method of color reproduction. Tri-color tubes or any other method of color reproduction that is applicable to any other color system can also be used with the *CBS* color TV system. At the present time the motor-driven disc or drum provides the most practical and economical means of color reproduction with a high degree of color fidelity.

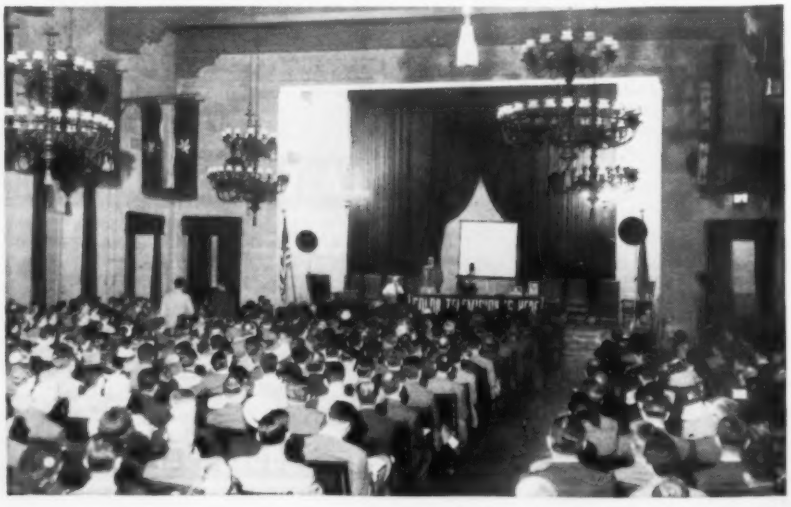
The new color TV standards call for different scanning rates than our present black-and-white television. Because of this present receivers cannot reproduce color telecasts in black-and-white until they are *adapted* to follow the color transmitter's new line, field and frame rates. This particular requirement is the major disadvantage of the *CBS* system. Because of this the field sequential system has been designated an "incompatible" system.

A decided advantage of the *CBS* system is that present transmitters can be modified, at a nominal cost, to telecast pictures in color—or rather, by the new line, frame and field rates—and that practically all receivers now in use can be adapted and converted to receive these telecasts and reproduce the pictures in color.

This department is not concerned with the relative merits of the different systems of color TV. To argue their respective pros and cons is like arguing politics or religion.

A system for color television has been approved. The general public will, in the final analysis, present the verdict that will either approve or disapprove of FCC's action in selecting the field sequential system. If past experience teaches us anything it is that the one best way to perfect a product is to get it out of the laboratories and into the hands of commercial companies and the general public where

An overflow crowd of technicians jammed the main auditorium of the U.S. Chamber of Commerce Building in Washington D. C., to witness a demonstration of color TV presented by CBS engineers and to hear Edward M. Noll's lecture. Sponsored by Rucker Radio Wholesalers of Washington and presented by the Television Technicians Lecture Bureau, this was the first of a series of color lecture-demonstrations for TV shop owners and technicians to be presented jointly by CBS and the Bureau.



use will dictate the needed changes and improvements.

The major concern of this department is in how color television developments will affect the radio-TV service industry.

There are more than ten million television receivers now in use. Most of these sets can be adapted and converted to receive and reproduce pictures in color with the *CBS* system. Assuming that the public will accept color television and a popular demand for color telecasts sweeps the country—as it did for our present monochrome television—what will happen in the service business? Will the trend be toward the adaptation and conversion of the users' present receivers or will the major demand be for new receivers, factory-equipped to reproduce color television? If the demand is for new color receivers and the present receivers are traded in, will a new business spring up to sell converted used television receivers?

From the standpoint of the service industry the widespread acceptance of color television will present some interesting and unusual possibilities. To get a clear picture of what is involved let's briefly examine the several ways in which current receivers can be modified to receive and produce color pictures.

Methods of Modifying Receivers

The first step in modifying a receiver for color is to *adapt* it to produce a black-and-white picture with the new scanning rates. With some of the present sets this modification or adaptation can be accomplished rather simply by adding several new component parts with a switching arrangement to retain the receiver's usefulness in receiving black-and-white pictures telecast under our present standards.

However, what will probably prove to be the most satisfactory and popular method for adapting sets will be to use factory built adapter units. These complete assemblies, designed for use with specific circuits, will permit the adaptation of a receiver without adding parts to its present circuits. Such adapters will connect to the sets by means of adapter plugs inserted in specific tube sockets. They will contain all of the necessary circuitry to produce the new scanning rates.

After the set is adapted the picture will appear on the face of the CR tube as a black-and-white picture. It is necessary to add a *converter* to be able to see the picture in color.

To convert any of the present sets it will be necessary to use the circular type of color disc. The maximum practical size of picture that can be produced with the circular color disc is about 12½". A motor drive unit and motor speed control circuit together with the disc make up the color converter. Since practically all of the color converters will be available as complete, enclosed assemblies, a suitable magnifier will be included with it to present a larger image.

Then there will be the "color com-

panion" sets which several manufacturers have developed. This is a "slave" type of receiver that contains its own picture tube, color converter, and the necessary electronic circuits for color requirements. It is connected to the driving set through a cable and socket adapter. The present receiver is left intact and continues in use for black-and-white pictures from monochrome stations. The companion set is used only for the color pictures.

Potential Modification Business

Five years ago when television first burst upon the post-war scene direct view TV receivers were limited to seven and ten inch picture tubes. However, design and production problems were whipped rapidly and the larger direct view tubes became commonplace. This development occurred so fast that the bulk of the smaller screen sets were sold mostly in the early television areas.

It wasn't too long after the smaller screens became passé that ingenious suppliers started to offer conversion kits for converting these sets to larger tube sizes. Although this conversion business has been confined to a very few areas, alert TV service contractors in those areas found it to be a substantial and profitable business. Many of them set up production line systems for converting receivers and by concentrating their conversion sales efforts on a single, widely-used model at a time they have been able to maintain a consistent level of service income from this activity.

With more than ten million TV sets now in use and a half million-plus completed receivers stacked up in warehouses crying for buyers it is not difficult to visualize the tremendous business potential that would result from a wide-spread TV user demand for color television. It is estimated that the average receiver can be adapted and converted to color at a cost of $150.00. With that tremendous income potential it is entirely possible that a new "color modification" industry will join the television ranks.

But what can it mean to the man who is running a one-man, five-man, or twenty-five-man independent service business? Is this one of the potential possibilities in TV installation and service that impelled a giant company like *Western Union* to get interested in it?

The first impact of color TV will come in the present major television areas. During the first few months that color TV will be on the air color telecasts will be available only at odd hours during the day and perhaps late in the evening. It will take some time for manufacturers to design, tool up, and produce the adaptation and conversion accessories necessary for wide-spread receiver modification. However, it has already been announced that several advertisers, some of whom have never used time on black-and-white television, are prepared to sponsor color television programs.

There are many substantial, suc-

cessful independent TV installation and service companies in business in the areas where color will first be tried. These service companies are owned and managed by able service businessmen who built their businesses solidly enough so that they were able to weather the serious business storms that swamped the poorly managed shops.

These organizations will be alert to the new opportunities that color TV will provide and they are capable of taking full advantage of them. However, there is a top limit to the volume of installation, service, and conversion business that even the best financed and managed service companies can handle and continue to operate on a profitable basis. It has been clearly demonstrated that an independent service company can get to be too big.

So under the most favorable circumstances the present independent TV installation and service organizations in the major centers would be able to handle, at most, only a small percentage of the color modification, installation, and service business.

The most interesting aspect of the new business that color TV will create in television areas lies in speculating on whether new, independent service businesses will be organized to handle set modifications or will the larger receiver manufacturers expand their wholly-operated or distributor-operated consumer TV service departments to take care of this business. Of course, there is also the possibility that more big TV installation and service companies along the pattern of the proposed *Western Union* organization, will be created to grab a share of this new business.

It will provide ample opportunities for present small service operators who are able to finance and manage expanded businesses, to extend their activities on a sound basis. And it all adds up to a need for a growing army of skilled technicians that will be required by the business regardless of the nature of its financial ownership and management control.

Color television will add the impetus to business in the present TV-served areas that u.h.f. TV will furnish for presently non-television areas.

CBS To Sponsor Training Program

CBS plans to present a training program for experienced TV technicians on their color TV system. Although complete details of this program have not been announced they have been working on various phases of it for some time. Their recent merger with *Hytron* and *Air King* provides them with manufacturing facilities to produce receivers of their own design.

Opportunities for Small Dealers

It is highly questionable whether a small service business will be able to cope with the problems of color television. Color programs will educate viewers to be more critical of the quality of their pictures. It will dem-

onstrate the necessity for a good installation for insuring consistently good pictures.

Many TV set owners have never seen a picture on their sets as good as it could be if the set had a properly installed antenna system. But many picture defects that have been glossed over in black-and-white reproductions will not be tolerated with color.

And right around the corner is u.h.f. television. It will pose new requirements for service capability and efficiency. It will add another incentive for good set installations including, of course, an efficient antenna system.

In all major TV areas the skilled manpower demands on service companies will require managerial abilities that can be supported only by an organization of substantial size. In other words, a small company cannot support the necessary investment in equipment, supplies, stock, etc., and pay the necessary management salaries out of the income produced by a few technicians.

The opportunities for the small service companies will come in connection with u.h.f. TV developments in the smaller cities and towns. However, the demands that will be made on these new service businesses in technical facilities, TV installation and servicing "know how," and in service business management will be far more exacting than was required of the service operators who went into v.h.f. television in its early days.

Each receiver installation in an area that is essentially a u.h.f. area, will be in the fringe or far fringe range of other u.h.f. or perhaps v.h.f. stations. And it is quite probable that set owners in u.h.f. areas will want to get the maximum number of stations on their receivers that the best installation will permit. So a u.h.f. TV installation and service operator should anticipate that both the facilities and the ability to make good antenna installations will be a *MUST*.

Nominal Business Requirements

Technically competent service operators and technicians who are hoping to establish themselves in the TV installation and service business when u.h.f. TV arrives should set up a "preparedness" program for themselves right now even though u.h.f. is still in the indefinite future. It will come and when it does business moves so swiftly that there is no time to learn what should have been known beforehand.

Preparation for a u.h.f. service business should embrace a continuing close study of both the technical developments in v.h.f. and u.h.f. and a study of the fundamental management problems of a retail service business. We have observed that competent service shop operators keep pretty well informed on technical progress and developments but neglect the study of business management.

The major hurdle for the technically trained service operator in entering the TV installation and service picture is that of efficient organization and man-

agement of a TV service *business*. In the first place, a TV service business requires the investment of a substantial sum of money. If the necessary equipment, supplies and replacement tubes, and parts working stock are not purchased the business will deteriorate from inefficient operation. On the other hand, if the business credit is used to buy equipment or supplies that are really "capital investment," with the hope of paying for it out of income, the business will soon be in serious financial trouble. So it is excellent business insurance to arrange for adequate financing before you get into the TV installation and service business.

Another extremely important factor in the successful operation of any retail service business is in the proper management of "time." "Time" is the basic commodity that a service business has to sell. And the financial loss in a service business from wasted or inefficiently applied "time" is just as real as the loss would be to a groceryman whose employees wasted or destroyed the foodstuffs they handle.

Even a minimum sized TV installation and service business will have a substantial investment in replacement tubes and parts and in the supplies used in various phases of the activity. Here, too, substantial losses can occur unless adequate stock controls are maintained that will provide a constant check on all types of material bought and used.

Then there is a continuing sales problem to maintain a satisfactory volume of service business. Payrolls have to be met regularly if a stable technical organization is to be maintained. In order to keep your volume of service business at a satisfactory level you will have to make numerous and constant dealer contacts and have some sort of a continuing "service-sales promotional" campaign to set owners.

Gather and study all the data you can get about how successful TV service contractors manage their businesses. Develop a file of the various forms that are used by service contractors and study them in relation to the business you plan to develop. Make use of the sales promotional material that manufacturers make available to you. This material is prepared by men who are authorities on service merchandising and in using it you are putting these men to work for you. —30—

"Elbert! Stop bothering the television man!"

Technical BOOKS

"F-M SIMPLIFIED" by Milton S. Kiver. Published by *D. Van Nostrand Company, Inc.*, New York. 453 pages. Price $6.50. Second Edition.

This second edition of Milton Kiver's popular handbook on frequency modulation has been rearranged, rewritten, and brought up-to-date to conform with the developments that have taken place in the field since the first edition appeared in 1947.

This new text contains complete information on the construction and operation of FM receivers and transmitters and their accessory units, the operation, installation, and servicing of all present-day FM equipment, and a detailed troubleshooting procedure for locating service faults in the power supply, audio amplifier, FM detector or discriminator, the i.f. system, and the r.f. section of the receiver.

Like the first edition, this new volume is designed as a self-study text and has, therefore, been written with some thought being given to the difficulties likely to be encountered by the student. There are test questions at the end of each chapter by means of which the tyro can check his grasp of the subject matter. This new edition contains more and more detailed diagrams than the previous edition, a feature which is of inestimable assistance to the student.

Three chapters have been devoted to a discussion of FM transmitters as manufactured by commercial suppliers of these units. These chapters, which classify the transmitters according to the method by which the FM signals are generated, are of particular value to persons planning to set up FM station facilities.

Like Mr. Kiver's other books on the subject of FM and television, this text is recommended for the beginner since it is a clearcut explanation of the subject written in easy-to-understand language.

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"PRACTICAL WIRELESS ENCYCLOPAEDIA" by F. J. Camm. Published by *George Newnes, Limited*, London. 360 pages. Price 21/-. Twelfth Edition.

This most recent edition of a standard reference work in the radio field contains new sections covering radar, television, remote control, oscillators, Kirchhoff's laws, photoelectric cells, a new series of circuits for receivers and amplifiers, automatic station selection, auto radios, electron multipliers, quartz crystals, amateur transmission, troubleshooting, building a television receiver, the new color codes, antennas, meters, a listing of short-wave stations, tubes, and a list of approved service terms.

The material is presented in alphabetical order which facilitates locating the desired subject. Although the

terminology is British, users on this side of the Atlantic should experience little difficulty in making the "translation" to the more familiar American terms.

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"UHF TELEVISION AND VHF-UHF TUNERS" by Edward M. Noll. Published by *Paul H. Wendel Publishing Company, Inc.,* Indianapolis. 52 pages. Price $1.00. Paper bound.

This is another of the "Notebooks" being issued by the Television Technicians Lecture Bureau for the benefit of service technicians working in the television field.

This "Notebook" is divided into two main sections covering v.h.f. tuners and u.h.f. television. The first section deals with such subjects as the function of the TV tuner; gain, sensitivity, and bandwidth; signal-to-noise ratio; interference; the alignment curve and its significance; typical commercial tuners; alignment; alignment procedures; tuner replacements; fringe area alignment; tuner troubles; and manufacturers' service notes.

The second section covers propagation at u.h.f.; influence of weather; polycasting; the *RCA* u.h.f. field experiment; u.h.f. converter methods, antennas at u.h.f.; u.h.f. converter circuits; *RCA's* experimental tuners; the v.h.f. and u.h.f. television spectrum utilization; and proposed channel allocations for v.h.f. and u.h.f. television.

This handbook is a thoroughly practical presentation of the subject and the text material is well-illustrated with circuit diagrams and line drawings.

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"MOST - OFTEN - NEEDED 1951 TELEVISION SERVICING INFORMATION" compiled by M. N. Beitman. Published by *Supreme Publications,* Chicago. 192 pages. Price $3.00.

This newest service manual in the *Supreme* series covers television receivers produced by twenty-seven of the leading video manufacturers.

As with the previous issues, the new manual provides a parts location diagram, a schematic, alignment material, special service hints, and oscillograms on each of the receivers covered. The material is presented in concise and often tabular form to speed service and eliminate time-consuming perusal of the text.

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AUGUST 1951

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